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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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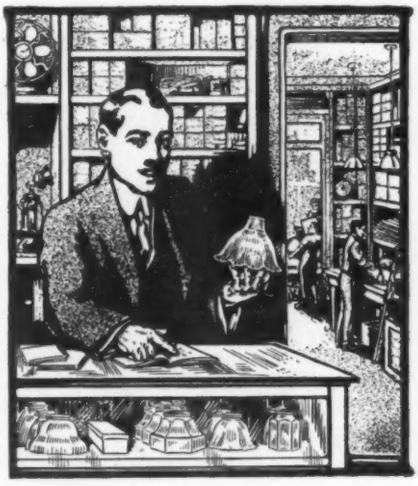
The success of Holophane has been due to two things—Holophane itself and the Illuminating Engineering service which we supply. As the public has come to know more about efficient and economical illumination, Holophane Reflectors and Holophane Engineering service have won greater prestige than that enjoyed, probably, by all other manufacturers combined. It is the well-balanced combination of high-class product backed by the most intelligent and constructive service that has made Holophane what it is today.



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"Building a Business on Service" is a new Holophane "instruction sheet" just out, which tells how the Contractor can make Holophane **his** business, how he can build up his own reputation and create his own market in the field of illumination, which will make this the most profitable branch of his work.

The new instruction sheet is written in plain United States English, with the facts and figures. It is full of pertinent suggestions to the Contractor, which appeals to his good business common sense. It isn't a mere advertisement, but a straight proposition that we would like to talk over with each Contractor personally, if we could call today and sit in his guest chair. It tells him in heart-to-heart fashion just how we have built up our own business, and how he can apply these same methods—this same Illuminating Engineering service—and make Holophane his own successful business in his own local field.

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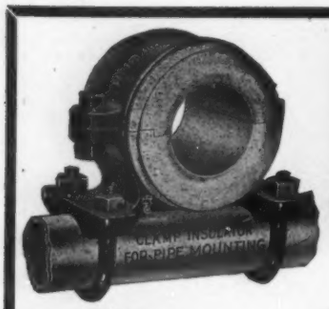
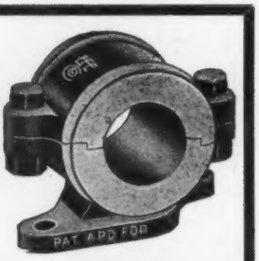
Alphabetical Index to Advertisers, Page 8. **Where to Buy It in the West, Pages 9, 10, 12.**





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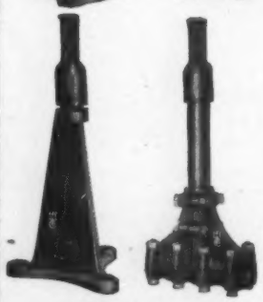

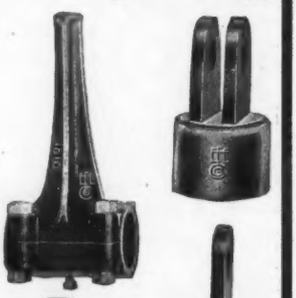
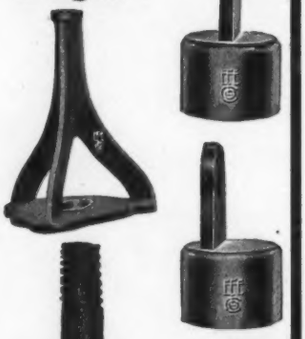

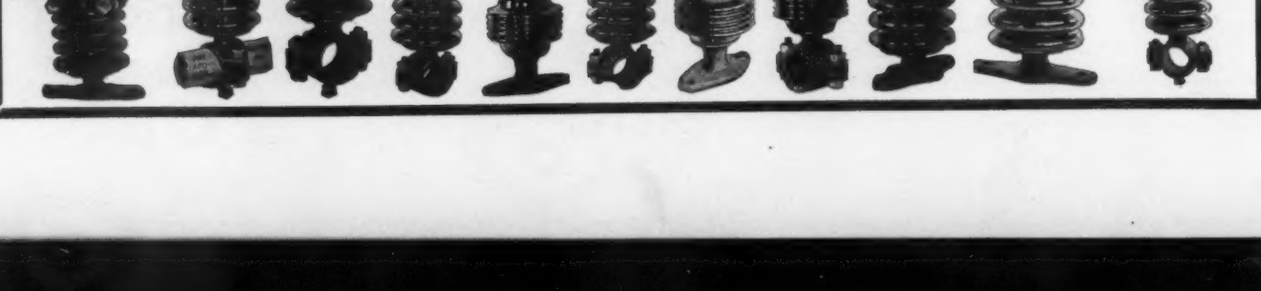

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HIGH TENSION DIRECT CURRENT TRANSMISSION[1]

BY C. F. ELWELL.

With one system about to go into operation at a voltage nearly as high as any existing alternating current system and another proposed, wholly underground, to use a voltage higher than this, it must be said that high tension direct current transmission deserves more than passing notice. The increase of losses from corona and convection currents, especially at the higher altitudes, points to the rapid approach of the limit of alternating pressures. The limit of distance in underground work is very soon reached with alternating current. With high tension direct current no corona or convection troubles arise, and apparently any reasonable distance can be covered either overhead or underground. Present methods of generating high tension direct current have their advantages and disadvantages. To realize these both in generation and transmission it would be well to look to the existing installations. Schedule No. 1 shows at a glance the progress of the past twelve years and it is well here to note that all of this is due to the perseverance and skill of one man, Mr. Thury, to such an extent that series systems have come to be known as "Thury" systems. If one man can accomplish so much, while a great many have been working on the development of the alternating system, it is hard to conceive what will happen when a similar weight of talent turns its attention to direct current. In the matter of the design of high tension dynamos it will be seen that the figures for the new station at La Roziere show an encouraging outlook.

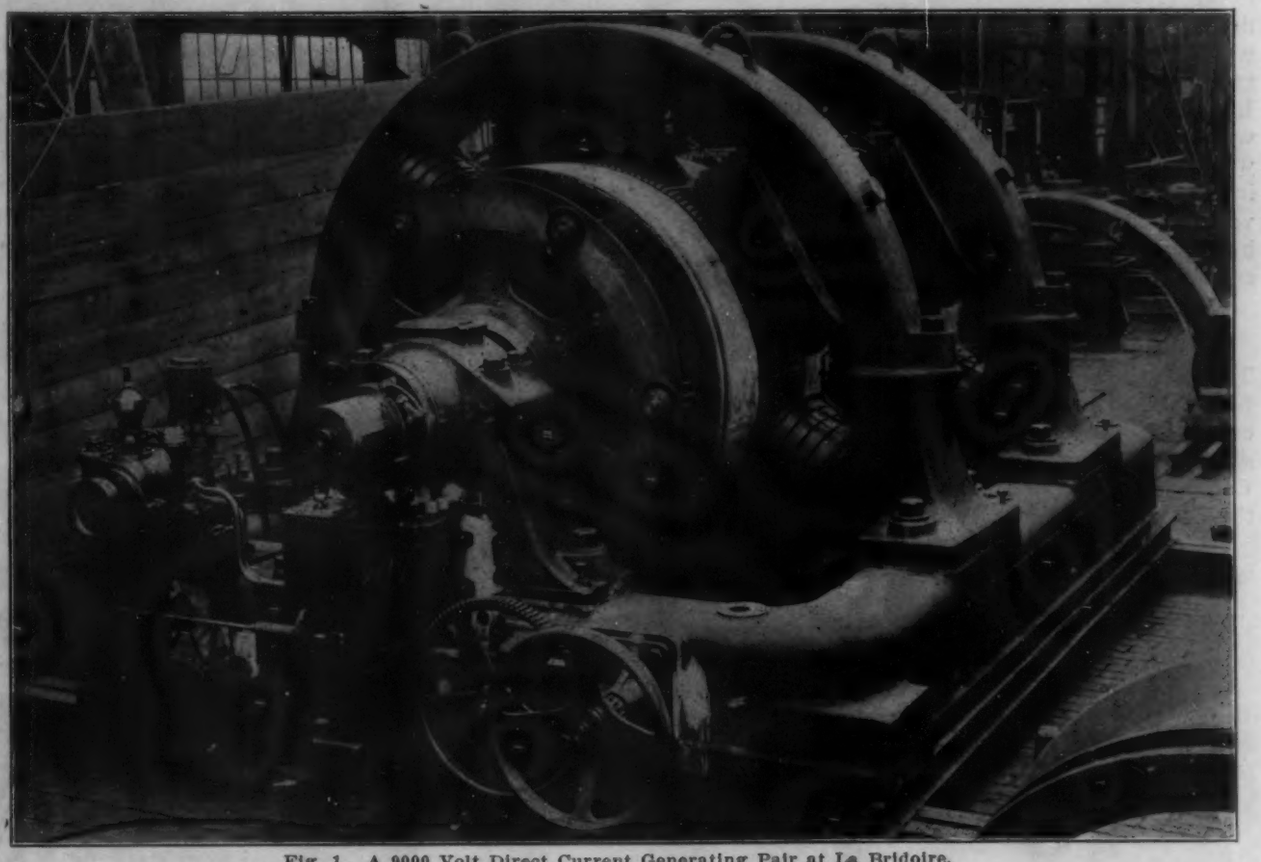


Fig. 1. A 9000 Volt Direct Current Generating Pair at La Bridoire.

[1] A paper delivered before the San Francisco Section of the American Institute of Electrical Engineers, October 28, 1911.

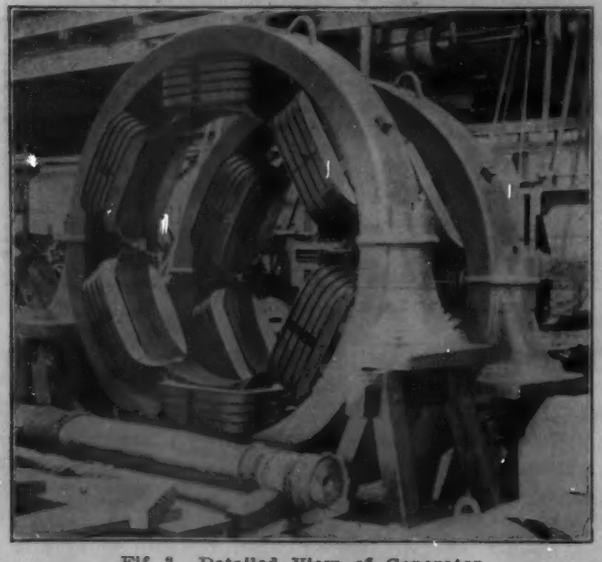
Fig. 2. A Direct Current Installation at Moutiers, Savoy, France.

The Moutiers-Lyons Transmission.

As originally planned and carried out in 1906, the generating station at Moutiers, Savoy, France, generated 75 amps. at 57,600 volts and transmitted the same to two substations in Lyons, a distance of 112 miles (180 km.) This has worked so successfully that a new station has been completed at La Bridoire which generates 150 amperes at 24,000 to 27,375 volts, and this together with another station building at La Roziere which will add from 32,000 to 35,500 volts, will be put in series with Moutiers, which, however, will be changed over to 150 amperes and the three in series will give 150 amps. at approximately 93,000 volts. The existing line and insulators will of course be changed, and additional load installed in the substations.

Generators.

Fig. 2 gives a view of the station at Moutiers. There are four sets direct connected to four turbines, but insulated from them by means of an insulating coupling. Each set consists of two double machines, separated by means of another insulating coupling. Each double machine has two armatures mounted on the same shaft.



Fif. 3. Detailed View of Generator.

One armature generates 3600 volts at a speed of 300 r.p.m., giving 14,400 volts for the set. The four sets in series give the present line voltage of 57,000. As the middle point of a pair of armatures is connected to the frame of the machine and in case of a ground on the line, there would exist approximately the whole line tension between the earth and the machine, it is very necessary that the whole be carefully insulated from earth. This is done by mounting the machines on insulators which are embedded in concrete made with lava, and the whole is covered with a layer of asphalt. The floor of the room is tiled with vitrified tile and the commutators of the machines may be touched with impunity. Further details of the generators can be seen by referring to Appendix A.

Fig. 1 shows a set as installed at La Bridoire. Each armature generates 150 amperes at from 4000 to 4562 volts giving 8000 to 9125 for the pair. At Bosel four of these will be mounted on each turbine giving 150 amperes at 16,000 to 18,250 volts. The generators at Willesden, London, England, are for 100 amperes at 5000 volts per armature.

Turbine Regulator.

In series with the line, with a shunt inserted, is a regulator which acts on all the turbines at once. The mechanical connections to the turbines can be seen in Fig. 2. This regulator works as follows: (See Fig. 5, which is a wiring diagram of the system). The small motor M drives a system of pawls continuously to and fro. The line current passing through the solenoid S_r acts on its armature which is balanced by a spring and which is attracted more or less as the current tends to increase or diminish. Its core works a lever which causes the pawls to engage a toothed wheel which works in either direction and through shafting controls the water in the turbines. Fig. 3 gives a view of the apparatus.

Switch Gear.

Each set has a pedestal (See Fig. 2) on which an ammeter and a volt-meter are mounted. On top of the pedestal two horn gap arresters in series are located and set as a tension limit for the group. The controlling switch for the set is also mounted on the standard. At the end of the machine there is a short-circuiting switch which is immediately tripped if the machine reverses its direction.

The main switchboard panel contains nothing but an ammeter voltmeter and wattmeter, with their respective shunts, and a short circuiting switch for the whole station.

Protective Apparatus.

The apparatus is protected from static by 40 horn gap lightning arresters in two sets of ten each in series and two sets in parallel. Each set is connected to earth through an electrolytic resistance to limit the discharge current.

A self induction is inserted in the main circuit between the machines and the point of connection of the lightning arresters to the line. This consists of 10 coils of iron of square cross section, mounted on insulators on the walls. See Fig. 5.

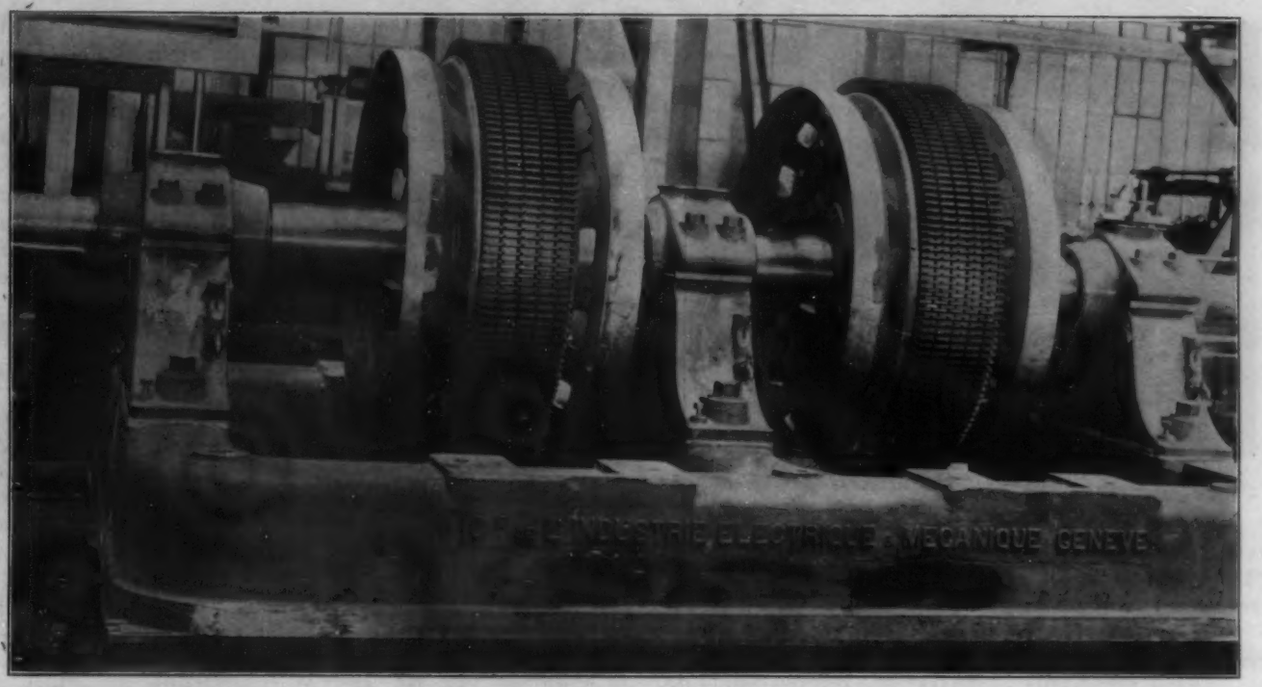


Fig. 4. 3800 Volt Direct Current Motors.

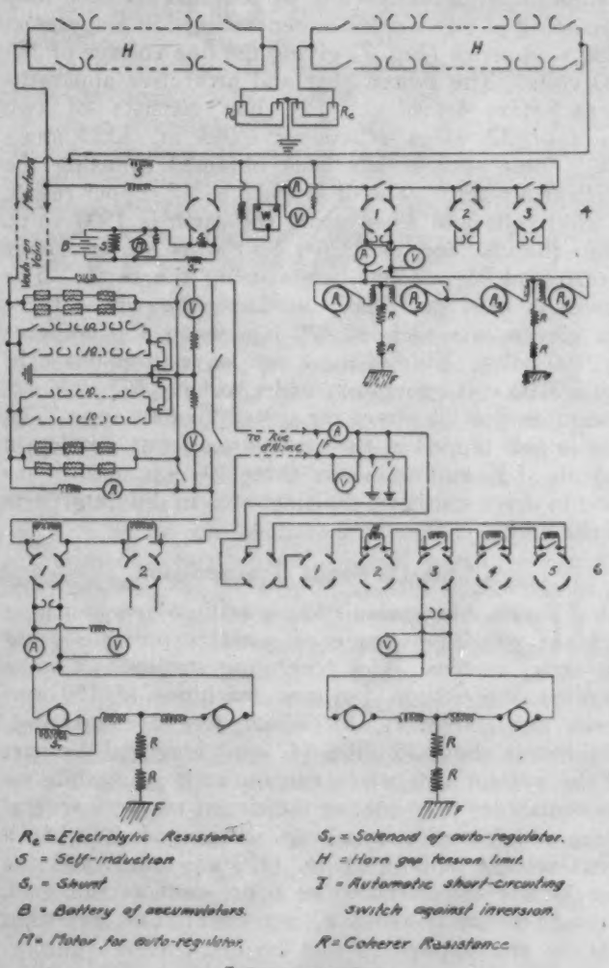


Fig. 5. Diagram of Wiring.

The Line.

The line consists of two copper conductors each 0.354 in. (9 mm.) in diameter mounted on triple petticoat insulators. From Moutiers to Sablonnieres the line is on wooden poles and thence it is on steel poles which also carry two three-phase 26,000 volt lines. These poles are 52.5 ft. (16m) high and 317 ft. (100m) apart. The resistance of the two wires is about 90 ohms and the drop about 7000 volts corresponding to a loss of 525 kw. and as this is constant the efficiency of the line is 88 per cent with full load of 4320 kw. There are 15 controls on the line all connected by telephone. The part of the line from Vaulx-en-Velin to Rue d' Alsace, a distance of 6 miles is an underground lead covered cable. These cables consist of 19 wires of 0.088 in. diam. (2.24 mm) with an insulation thickness of 0.71 in. (18 mm). The capacity is 0.12 mfds and resistance 2 ohms with an insulation resistance of 1610 megohms per mile (1000 megohms per k.m.)

Substation at Vaulx-en-Velin.

Vaulx-en-Velin is the end of the overhead line and in addition to absorbing some of the power is equipped to prevent disturbances from the line affecting the underground cable (Fig. 5). This protection consists of horn gaps, coherer resistances and Moscicki condensers. There are 40 horn gaps arranged in series parallel and having electrolytic arresters in series with each group to limit the current of discharge.

The coherer resistances consist of porcelain tubes with metal electrodes and containing a conducting powder mixed with an insulating powder. To direct current this offers a considerable resistance, but to high frequency currents the resistance is much less and this allows the line to discharge. These are connected together by gaps adjusted to stand the normal line potential.

The Moscicki condensers are arranged in four groups of eight condensers in parallel on each pole. They take care of atmospheric discharges which being high frequency pass readily through the condensers to earth.

Fig. 6. Generating Station at St. Maurice.

At present the station has two groups of d.c.-a.c. reversible motor generator sets. Through transformers they can take or furnish 26,000 volts three-phase alternating current.

They consist of two 375 h.p., 3800 v. d.c motors in series on the same shaft (Fig. 4), with a 500 kw. three-phase alternator of 10,000 volts. See appendix B for characteristics of these machines. Ordinarily the motor drives the alternators but the three-phase alternators may be run as motors and the station furnish d.c. to the station at Rue d'Alsace. The speed is kept constant by means of a motor regulator which is similar in action to the turbine regulator but which is driven by means of a belt off the main shaft. This regulator adjusts the brush position to keep the speed constant as the load varies and may be seen in Fig 5.

Fig. 7. Line Voltage of 27,000 Direct Current.

Each set is served by a pedestal on which is a voltmeter, disconnecting switch and tension limits. This substation has just been equipped with three more 150 ampere motors at 9125 volts, to absorb the power to be generated by La Bridoire and four similar motors will later be installed to absorb the power from the generating station which is now building at La Roziere.

Substation at Rue d' Alsace.

The cable runs to a switchboard on which are mounted an ammeter, voltmeter and short circuiting switch. There are at present 6 machines driving 500 kw. 600 v., d.c. dynamos which supply the street cars of Lyons. The series machines are exactly the same as the 3800 v. machines at Vaulx-en-Velin.

St. Maurice-Lausanne Transmission.

This transmission of 4000 kw. at 27,000 volts over a distance of 34.8 miles (56 km.) has been in successful operation for the past nine years. The generating station at St. Maurice (Fig. 6) contains six sets, each consisting of two machines generating 150 amperes at 2250 v. in series (Fig. 7) giving the line voltage of 27,000 volts. The switch gear and protective apparatus is as before described. The line consists of two leads of 37 wires of copper 0.088 in. (2.25 mm.) dia. Some success has been obtained in using the earth as a return. The drop when using copper return is 2160 volts and when using the earth is 1500 volts. Thus the efficiency is 92 per cent when using copper return and 95 per cent when using the earth. The power is used principally at Lausanne where there are eleven sets each of 400 h.p. using 150 amperes at 2100 volts. Nine of those sets have three-phase 50 cycle 3100 volt generators and two have 675 volt d.c. generators for the street car system of Lausanne. The line is also tapped at the cement works at Paudex, a suburb of Lausanne, where three 400 h.p. motors are used to drive crushers, shafting, etc., in different parts of the mill.

Chaux-De Fonds Transmission.

Though this transmission is neither large nor long it is a splendid example of what is possible using the series system. The generating station at Combe Garot has provision for nine machines of 150 amperes at 1800 volts, of which five are installed. The line is about 26 miles (42 km.) long and for part of the system two wires run on each pole while on the remainder only one, as the circuit includes several cities and factories in a ring. The conductor has a cross section of 0.43 sq. in. (150 sq. mm.), and the line loss is calculated to be 6 per cent at full load, but at present is about 10 per cent. The following stations are supplied:

Locle.

Watch Factory	140 H.P.
Bank	20 H.P.
Chocolate Factory	40 H.P.

Chaux-de Fonds.
Street car and lighting: four.....260 H.P. Motors.
two.....100 H.P. Motors.
Abbatoirs: one..... 50 H.P. Motors.
Flour Mill: one.....140 H.P. Motors.

Eplatures.
General: five.....275 H.P. Motors.

Molliats.
General: two .....150 H.P. Motors.

At Rue de l'Industrie at Chaux-de Fonds a gas engine reserve station consisting of two Deutz 250 h.p. four cycle, two cylinder horizontal engines is located, while at Eplatures a Sulzer 850 h.p. engine is installed for emergencies.

Operation.

The operation of both generating and receiving stations is quite simple. The absence of switch gear impresses one with the simplicity of the system. To put a generator on the line it is started up on short circuit until its short circuit current equals the line current. It is then switched in and automatically speeds up until it shares the load equally with other generators.

In the substations the motors are switched in series with the line and the brushes are automatically brought forward by the regulator until the motor is up to full speed. To stop a motor the brushes are brought back by hand until the voltage is zero and then the armature is short circuited.

Any overload or short circuit causes the motor to slow up and if persistent the motor pulls up and only absorbs sufficient volts to overcome its ohmic resistance. This obviates any abuse of the motors, though on the other hand prevents their use with an overload for a short interval of time.

Advantages and Disadvantages.

From the foregoing the chief advantages and disadvantages of the series system can be noted.

The chief advantages of the series system are to be found in the line, but there are also advantages of operation and installation.

1. Absence of all effects arising from impedance and capacity.

2. Strain on insulating materials is by actual experiment less than half what it is with alternating currents at ordinary frequencies. Insulator losses are small and the absence of corona and convection current loss is a favorable factor, especially for high altitude transmissions.

3. Controlling switch gear is reduced to a minimum and the operations of switching do not tend to cause surges. Voltage regulation and parallel running are eliminated. Operation is simple and does not call for highly trained attendance.

4. It is possible to transmit to any reasonable distance and very long underground lines are also possible. Transmission line construction both in copper and insulators is much cheaper than with alternating current. Wires can be spaced any distance apart and a break in the line only affects a part of it. Underground transmission is cheaper. Allowable line drop may be greater than with alternating current.

5. A number of direct current systems can readily be coupled together with absolute safety. Increase in demand at certain points does not necessitate increase in size of mains.

On the other hand must be weighed the following disadvantages, mostly of generation.

1. Difficulty of commutation of large currents when there is a large difference of potential between bars.

2. Dynamos must be insulated from earth and from prime mover, which may entail some difficulty at extremely high voltages.

3. Present designs of high voltage dynamos are not adapted for connection to high speed machines.

4. The necessity of arranging a large number of machines in series to obtain high voltages.

5. The I^2R losses in the line are constant but may be reduced for certain hours of the day by reducing the line circuit and the power of the motors.

6. Maximum torque is limited and motors cannot be overloaded. Almost all application must be by rotary transformation.

Factors Governing Selection of Direct Current.

Every case is governed by local and other conditions, but the following factors will usually be found to be the most vital. If the load is fixed and not subject to increase then the selection of direct current or alternating current will present no difficulty. The chief saving in favor of direct current will be in the line and therefore the longer the line the more likely that it will be selected. Type of prime mover and cost of current will have to be considered on account of fixed I^2R loss. The direct current loss may capitalize more money than the line saving. Size of load and distance will have their bearing on size and number of units.

Number of dynamos also depends on voltage as at present, the limit per armature seems to be about 200 amperes at 5000 volts. Four of these can be run by one prime mover to keep down the number of prime movers. It will be interesting to hear from our manufacturers what they are willing to build at the present time.

Cheapness of insulation will favor a higher pressure being used with direct current than with alternating current and consequently a lighter line. Greater voltage drop is permissible with direct current than with alternating current on account of regulation.

Usually only a portion of the load is known and the ultimate size is unknown. In planning for alternating current if the area is restricted the pressure is fixed, but for direct current the current must be fixed at a value which will suffice later, as on the line current depends the size of machines and a change of line current would mean changing all machines. By putting up insulators with a margin and commencing with a low pressure the load can be increased by installing more units in series and increasing the pressure. This means that the direct current system would not be as efficient in the beginning as when the load increased. This current may be increased by putting pairs of units in parallel. The Moutiers Lyons transmission was worked for five years as a 75 ampere line and now will be connected into a 150 ampere line, by using the generators in pairs in parallel. The voltage generated by Moutiers will be less but the addition of the new station at La Bridoire and

SCHEDULE No. 1.

	Date of Inaugu-ration.	Line Cur-rent Amperes.	Line Pres-sure volts.	Total out-put K.W.	Dis-tance in Miles.	Details of Machine Units. No.	Volts.	K.W.	R.P.M.	Remarks.
Ste. Acquedotto de Ferrari, Galliera, Italy	1889	45	14,000	630	37.3	18				Ring circuit
Service des eaux de Zug, Switzerland	1891	50	8,000	400	14.9	5	1600	80	320	" "
Papeteries de Biberist, Switzerland	1893	40	6,800	272	11.5	2	3400	136	...	
Communes du Val de Travers, Switzerland	1895	65	9,100	590	21.7	3	2600	170	260	Ring circuit
						1	1300	85	450	
Ste. d'Eclairage Electrique, Brescia, Italy	1895	50	10,500	525	16	3	1500	75		
						2	3000	150		
Ste. Romande d'Electricite, Switzerland	1895	50	14,000	700	11.2	4	3500	175	...	Ring
Communes de la Chaux de Fonds et du Locle Switzerland	1895	150	12,600	1890	16.1	7	1800	270	300	"
Chaux de Fonds, Reserve Plant		150	5,000	750		1	2000	300	300	"
Usines Electriques d' Eisenbourg, Ikervar-Stein-amanger, Hungary	1896	65	9,000	585	40.4	3	1000	150	180	"
La Papelera Espanola, Renteria, Spain	1896	65	13,280	863	8.7	6	1500	97.5	260	"
						3	2600	169	00	
Ste. Industrielle d'Electricite, Rieti, Italy	1896	30	12,000	360	18.6	2	2740	178		
V. Dunand, Batoum, Russia	1899	50	2,600	130	6.2	4	3000	90	...	
Usines Electriques d'Eisenbourg, Ikervar-Sopron, Hungary	1899	40	10,000	400	74.6	2	1800	65		
Mines de Plomb, Linares, Spain	1900	60	10,500	630	18.6	4	2500	100		Ring
St. Maurice-Lausanne, Switzerland	1902	150	27,000	4050	34.8	3	3500	210		
Moutiers-Lyon, France	1906	75	57,600	4230	112a	6	4500	337	300	
La Bridoire, France	1911	150	24,000	3600	b	4	14400x	1080	300	
			27,375	4110		3	8000xx	1200	428	
La Roziere a Bosel, France	Building	150		4800	c		9125	1370		
				5480	d	2	16000x	2400	428	
Willesden, England	1911	100	15,000	1500	7d	3	18250	2740		
							5000	500		

x 4 armatures on each shaft. xx 2 armatures on each shaft. a. 6 miles of underground cable. b. To be cut in series with existing Moutiers-Lyons line. c. 7.5 miles from Moutiers and to work in series with Moutier and La Bridoire, giving approximately 93,000 volts. d. Underground cable. To be later part of 80 mile-120,000 volt circuit wholly underground.

La Loziere will increase the line voltage from 57,600 to 93,000.

Appendix.

A. Characteristics of Moutiers Generators.

No. of armature	4
Volts per armature	3600
Amperes	75
R.P.M.	300
Poles	6
Air Gap (7 m/m)	0.3"
Diameter of armature (123.6 cm)	48.6"
Axial length of poles (30 cm)	11.8
No. of slots in armature	111
No of coils	333
No. of commutator segments	999
Diameter of commutator (110 cm)	43.4"
Useful width of commutator (7.5 cm)	3"
No. of brush holders	6
No. of brushes per holder	2
Cross section of carbon brushes (30 x 8 mm)	1.2" x .32"

B. Characteristics of motors at Vaulx-en-Velin.

Horsepower	360
Maximum volts	3820
R.P.M.	428
Poles	4
Axial length of pole pieces (30 cm)	11.8"
No. of slots	111
No. of coils	333
No. of bars in commutator	999
Dia. of commutator (75 cm)	29.6"
Useful width of commutator (11 cm)	4.3"
No. of brush holders	4
No. of brushes per holder	3
Brushes (30 x 8 mm)	1.2 x .32

THE ENGINEER AND CITIZENSHIP.[1]

BY JAMES A. B. SCHERER.

This is an age of electricity.

"Thirty years ago," said a member of Congress to a newspaper reporter, "I walked six miles over a hot and dusty road from my country home to the county-seat to see a circus that advertised to have on exhibition a light made of electricity. There were scores of others in our neighborhood who went, not to see the circus, but to get a sight of this new marvel, the electric light.

"That was thirty years ago. Last month, on advice of my physician, I went out to a suburban sanitarium for treatment for a rheumatic trouble. At the corner I took an electric car that carried me to the suburbs. There I entered an electric automobile that whisked me a mile farther, to the sanitarium. Having arrived there, I was taken by an electric elevator to my room, where the attendant turned on the electric light and switched on the electric fan. A moment later the house physician came in. On leaving me, he said that I would be notified when to come down to the treatment room. Soon after his call an electric sign on the walls flashed the words, 'Treatment Room.'

"On going down to that apartment, I had an electric-light bath, after which the physician applied electric sponges to my aching joints. When I returned to my room the electric telephone at the head of my bed rang, and lying there, I talked to my secretary in the House office building in Washington. He had called me up to ask after my health.

"Just before day the next morning I awakened, and desiring some hot milk, summoned the night attendant by pressing an electric button. When I made known my wants the attendant retired, returning in a few moments with a small electric stove, on which he soon heated a palatable drink. Before rising that morning I had an electric massage. The nurse told me that he had just been attending a patient with a chill, and had materially relieved him by packing electric bed-warmers about him.

"During the forenoon I had a slight attack of nervousness. I was placed in an electric chair,—not the electric chair—and its gentle vibrations soon sent me off into a soothing sleep.

"During the afternoon I had occasion to communicate with a colleague on a matter that I did not care to trust to the telephone. Accordingly, I telephoned to my secretary to have the member in question call me on the telautograph punctually at a certain minute. This he did, within a quarter of a minute of the time I had set, for the clock at the sanitarium and the clocks in the House building are both connected by electric wire with the government official clock at the national observatory, and regulated to the second each day. Then I sat down and carried on a secret correspondence on an electric telautograph, by means of which the words were written by electricity at a distance of eight miles.

"When I recovered sufficiently to walk, I strolled one day up the valley to the source of all this power. It was a humble little stream that tumbled down through an iron pipe to a turbine wheel. I do not

[1] Address by the President of Throop Polytechnic Institute before the Los Angeles Section, A. I. E. E.

know which excited my admiration more, the numberless uses to which I had seen electricity put, or the simplicity of this falling stream that was the moving power of it; but I do know that my emotion did not compare in intensity with the amazement that I felt thirty years before, when I first beheld that glowing glass bulb under the canvas of the old circus tent in Indiana."

I went to that same circus. I am willing to wager a quarter of an hour—"Time is money"—against any reasonable stake, that the Congressman is talking about John Robinson's "greatest show on earth," and that the inimitable clown, John Lowlow, stood in his sight, as in mine, pointing now and then in comical fashion towards a tiny intermittent spark at the top of the center-pole. Unlike the Congressman, however, I was not nearly so much interested in the electric light as I was in the circus itself, for it was the first I had ever seen. Unlike him again, my sensations at that time as awakened by my first sight of the electric lamp were not nearly equal to the interest I feel in standing before this company, comprising, as it does, the men who have made possible the hydroelectric developments that lie behind all the recent interesting experiences of the gentleman in Washington. And yet, after all, my interest arises not so much from the wonder of your professional achievements as from the fact that the training necessary to accomplish them justifies the somewhat startling thesis of this address: that upon you rests the responsibility, and with you lies the capacity, to render the largest public service possible at this time to any citizens of the republic.

I believe that a crisis confronts us. The American people are determined upon a readjustment of the relations between the public and the utility corporations, whether you like it or not; and there is grave danger lest this readjustment (which is necessary) be harmful because ill advised.

It seems to me hardly possible to deny that such determination exists; that it constitutes our leading political issue. I remember talking a few years ago with a great "captain of industry" who scouted such an idea; he said that the agitation for "progressive" policies was a mere passing fad, and soon the American people would jostle down to their usual state of sobriety. I remember also that he was distinctly opposed to Mr. Taft's candidacy because Mr. Taft was "too progressive"; yet yesterday, when President Taft was enjoying the hospitality of Los Angeles and Pasadena, representatives of his party in thirty different States gathered in Chicago to endorse a presidential candidate in comparison with whom Mr. Taft has always been the most extreme of conservatives. What did we do in California a week ago today? So intent were the people on the main question of the election that they "voted in" every one of the twenty-three amendments in spite of the fact that the authors of several of these had discovered lurking dangers, and publicly requested that their amendments be repudiated at the ballot box. Bring it nearer home. The issue is becoming local and municipal. I understand that here in Los Angeles one of the candidates for mayor is making opposition to public utility corporations the chief plank in his platform. In Pasadena this has been the main question of local politics for several years. I have no doubt whatever that the utility corporations in that and other cities have been guilty of grave error in the past; but I am also sure that among the ranks of the reformers you may also find evidences of folly, and of prejudice against a fair adjustment of the situation. The leading cause of the intense political agitation the country through is this determination of the people to secure a readjustment between the public and the utility corporations. It is this that has given rise to the adoption of the initiative, the referendum, and the recall in California. Now, while I have no fear of the proper use of these tremendous implements that we have recently taken into our hands, I am afraid of a reckless abuse of them; and it seems to me that the engineer is today the only qualified mediator between the people and the public utilities.

Just here I would like to quote from an address delivered by Mr. Justice Hughes while he was Governor of the State of New York:

"It is the function of law to define and punish wrong-doing, and not to throttle business. In the fields of industrial activity the need is that trade should be fair; that unjust discriminations and illegal allowances giving preferential access to markets should be prevented; that coercive combinations and improper practices to stifle competition should be dealt with regardless of individuals; but that honest industry, obtaining success upon its merits, denying no just opportunity to its competitors, should not be put under prohibitions which mingle the innocent and the guilty in a common condemnation. * * *

"The line of progress lies not in arbitrary action, but in securing suitable publicity and supervision, and by accurate definition of wrongs and the infliction of proper punishment. The processes of justice may be slower and more laborious; but if we desert the lines of soberness and fair play to get quick results through arbitrary interferences with trade, we shall find that such short cuts lead only to disaster.

" * * * In our progress we must seek to avoid false steps. Ours must be the rule of reason, clear-eyed, calm, patient and steadfast; defeating the conspiracies of intrigue and escaping the pitfalls of folly."

Suppose that I am a simple-minded gentleman of bucolic tastes, one of whose chief assets is a large, sleek, powerful, but sometimes rambunctious bull. Sometimes—especially if I flaunt an innocent pocket handkerchief which in his eyes appears as the red rag of socialism—he is rambunctious even to the extent of chasing me out of the lot or throwing me down and prodding my pockets inside out, or even prodding in the neighborhood of the habitat of My Lord Appetite, who never stands for credit but always calls for cash in spite of the high price of food stuffs. Suppose that I escape with my life, as the American people are commonly in the habit of doing. Two courses are open to me: either I may give way to passion and blow my bull's brains out with a blunderbuss, or I may make use of my intelligence. In the latter case probably I should get together a band of strong, wise and expert gentlemen, such as these before me; drive my bull into a corner, put a small ring through his nose, and preserve him as a valuable asset within a reasonable pasturage and without danger to the public welfare.

I do not need to make my application; I see that you have already made it for yourselves.

In order that engineers may render the immense public service which the times demand, it is not sufficient that they possess merely a professional competence. Such competence may fairly be assumed. But in addition to this, the crisis requires that an engineer shall be a man of affairs; versed in business usages to the extent of being an "efficiency engineer"; but versed also in economics and the history of American political reform. The helpful engineer must be nothing less than a publicist. It is a pity that our word "politics" has fallen into such sad repute. In its origin it is a word of dignity; denoting labor for the common welfare, the common weal; that is to say, the commonwealth. An engineer must not only know his own profession but he must know politics; be in touch with the spirit of the times and able to assist in a proper direction of political reform. I wish that if this talk bore no other fruit it might at least bring to your attention Mr. Herbert Croly's book on the "Promise of American Life." Himself an engineer, he has traced in a logical and philosophic manner our political growth; pointed out the problems that confront us; and then, with the skillful hand of a master, has planned the way for constructive reform.

An engineer, then, in addition to being professionally competent must be a man of affairs and publicist; but beyond that and above all that he must, in order to do his great work, be, to an extent required of no other profession today, a man of known unimpeachable integrity. When you come to the very crux of the matter, the real obstacle in the pathway of your helpfulness to the public is the stumbling-block of doubt, or lack of confidence, on the part of the people in your incorruptibility. I do not question that the character of the average engineer is far above that of the average man in the street; my point is that you must have an extraordinary hold upon the people in order to win their confidence at this crisis, so that they will give into your hands the solution of obscure and complex problems with which you alone are competent adequately to deal.

It seems to me that the very nature of your profession should make possible the attainment of extraordinarily high standard of character. Take your vocation, if you please, in comparison with the "three learned professions," as they used to be known. The physician necessarily juggles with the credulity of his patient, and plays upon his foibles in order to relieve him of imaginary ailments; thus the physician is open to subtle temptations that may undermine absolute truthfulness of character. The lawyer, by the very nature of the case, must consider solely his client's point of view and become a special pleader, committed by duty to prejudice. Even the clergyman, in order to harmonize the entire body of scriptural teaching, is in danger of quibbling with his exegesis. But it is yours to seek the clear, cold truth, and to declare it without fear or favor. This is the chief glory of science, high priestess of our modern civilization. If you fail from the high standard of truth, it is likely to be not by virtue of these subtle temptations that beset members of other professions, but from those that are gross and palpable, amounting to the sheer corruption of bribery. When the American people attain to complete confidence in the unimpeachable integrity of the engineering profession, their Yankee common sense will lead them to turn over into your hands, as a commission, the complicated questions involved in the readjustment upon which they are determined; and then this readjustment can be wisely accomplished, with the avoidance of that havoc which comes from ignorant bungling with a delicate mechanism. I repeat the thesis with which I began; that upon you rests the responsibility, and with you lies the capacity, of rendering the largest public service possible for any class of American citizens at this time.

Speaking as one interested in the progress of education, it seems to me that there is no more important duty for an educator than to assist in the training of such engineers as those I have attempted to describe. Indeed, the more I think upon the subject of engineering education, the more strongly do I come to believe that the modern engineering college is in process of evolution into the typical twentieth century school for all sorts and conditions of men. Suppose even that a boy is going to be a preacher or a lawyer. I go so far as to say that he would make no mistake in taking our courses. He would get his Hebrew and Greek or his Blackstone after leaving here—in his professional school—with philosophy and psychology and the rest of it, which we do not profess to supply. Here he would get as much English and French, or German or Spanish, with history and civics and business law, as he could get at the old-fashioned school; and, in addition, such a working knowledge of science as would put him in touch with the spirit of his age, besides providing a means of making his living should he wish after all to quit preaching or to give up law.

I believe that as the engineer stands today as potentially the type of the most useful American citizen, so the engineering schools are developing into a true pattern for the school of tomorrow, whose chief mission must be a high citizenship, trained in the higher efficiency.

HOW TO DETERMINE THOROUGHNESS OF COMBUSTION.[1]

BY ROBERT SIBLEY.

In previous lectures we have found that when fuel is burned in combustion the flue gases are composed principally of carbon dioxide, carbon monoxide, superheated steam, oxygen and nitrogen. It is of utmost importance at times to know the proportions of these different gases as they are found in the chimney of the power plant. If now some device can be rigged up in which we can absorb the gases in definite proportions by volume in separate bottles our task is accomplished.

It has been found in the study of chemistry that a mixture containing one part by weight of caustic potash in two and one-half parts of water, will absorb carbon dioxide. Similarly by dissolving one part by weight of pyrogallic acid in two parts of hot water and three parts of caustic potash solution as described above the resulting mixture will absorb oxygen. And

[1]This paper comprises the Tenth Lecture of the "Primer of Applied Thermodynamics," which is a resume, devoid of higher mathematics, covering the essentials of a series of lectures now being given by the editor of this Journal before the Mechanical Engineering students at the University of California.

finally by dissolving one part by weight of cuprous chloride in seven parts of hydrochloric acid, then adding two parts of copper clippings and let stand for twenty-four hours, afterwards adding three parts of water before using, a mixture is found which readily absorbs carbon monoxide gas. Now, then, if we can entrap a known volume of flue gas under a given

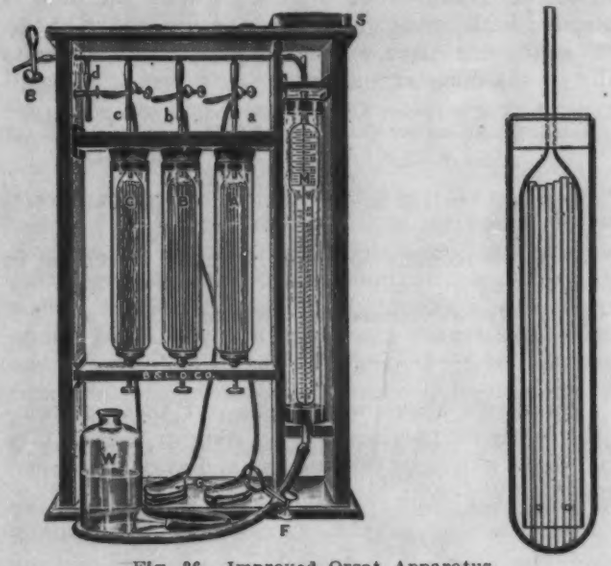


Fig. 26. Improved Orsat Apparatus.

pressure and then force this gas into intimate contact with each of these solutions in turn until these particular gases are absorbed in their respective bottles and then measure the volume left under the same original pressure, we can compute at once the percentage of volume of each of the three particular component gases above mentioned in the flue gases. Repeating this process with utmost thoroughness we finally determine with exactness the carbon dioxide, carbon monoxide and oxygen in the flue gases. The superheated steam in the escaping gases is condensed into water during the measuring of the other gases.

The action of hydrogen in coal or other fuel is to increase the apparent percentage of nitrogen in the flue-gases because of the condensation of the water vapor at the time of the analysis. The nitrogen, however that accompanied the oxygen with which the hydrogen combined, maintains its gaseous form and passes into the analyzing apparatus with the other gases. Hence although by means of our apparatus we measure the carbon dioxide, carbon monoxide and oxygen only, we can compute the other constituents; namely, water and nitrogen.

The socalled Orsat apparatus is usually employed to accomplish the results above described. Fig. 26 is an illustration of this apparatus. It is convenient at times to have a permanent record of the CO_2 or carbon dioxide content in the chimney gases. Fig. 27 is a socalled combustion recorder which records the carbon dioxide content at all times. The instrument shown has been tested by the Bureau of Standards and found from a series of tryouts to have an error well within 0.75 of one per cent.

It is interesting to note that air is found by experiment to be composed of 79.09 per cent of nitrogen and 20.91 per cent oxygen by volume, and 76.85 per cent of nitrogen and 23.15 per cent oxygen by weight. Since one unit by volume of oxygen forms one unit by volume of carbon dioxide in the burning of pure carbon, the actual percentage of nitrogen in the chimney gases is not altered but should remain 79.09 per cent. On the other hand one unit by volume of oxygen forms two units by volume of carbon monoxide gas. Hence when pure carbon is the fuel, the sum of the percentages of carbon dioxide, oxygen, and one-half the carbon monoxide must be in the same ratio to the nitrogen as is oxygen in the air; namely, 20.91 to 79.09. This is a convenient check in computations. Thus an analysis of chimney gases is found to contain by volume 9.5 per cent carbon dioxide, 5.2 per cent oxygen, 10.2 per cent carbon monoxide and 75.1 per cent nitrogen. According to the law above we should have

$$\left(9.5 + 5.2 + \frac{10.2}{2}\right) : 75.1 - 20.91 : 79.09$$

By actual multiplication the relationship will be found very approximately true. In fact well within the limit of error in a careful analysis.

As fuel usually contains some hydrogen we cannot apply the above test to the chimney gas analysis unless that proportion of nitrogen which was in the air

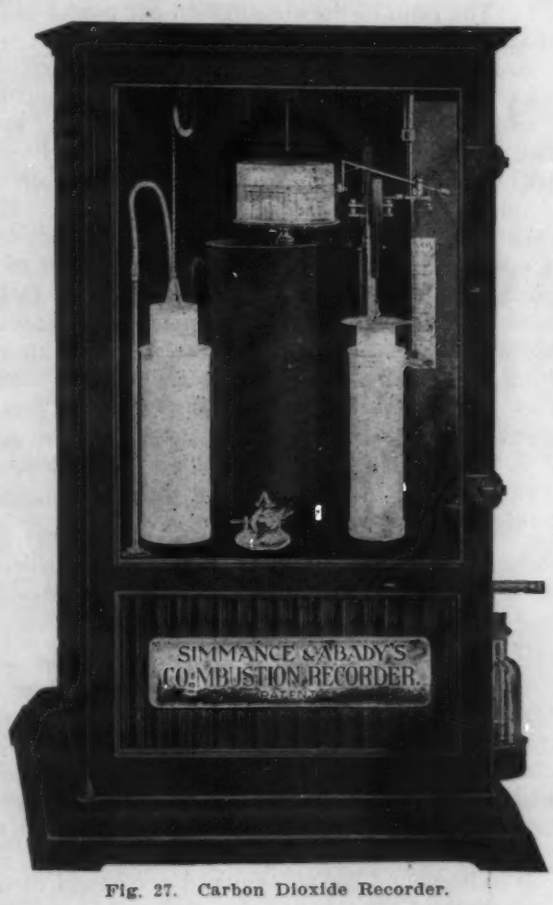


Fig. 27. Carbon Dioxide Recorder.

that went towards consuming the hydrogen be separately accounted for. This can be done by computation involving the hydrogen content in the fuel.

It is seen that the analysis made by the Orsat apparatus is volumetric or in proportion to the volumes of the component gases. It is frequently neces-

sary to convert proportions in volumes to proportions by weight. In order to accomplish this result it is simply necessary to multiply the percentages by volume by the molecular weight of the gas, and divide by the sum of all the products. The quotient so obtained will be the percentage by weight.

In the Third Lecture of this series we found that chemical substances combine according to certain definite parts by weight, which are multiples of the socalled atomic weights. These can be found in any book on elementary chemistry. The molecular weights of the gases met with in flue gas analysis are easily determined from these atomic weights. Thus,

Substance	Chemical Formula	Molecular Weiget
Carbon dioxide	CO_2	$12+2\times16=44$
Carbon monoxide	CO	$12+16=28$
Oxygen	O_2	$2\times16=32$
Nitrogen	N_2	$2\times14=28$

We are now ready to compute every factor entering into combustion analysis. The facts desired in a test are the following:

1. The flue-gas analysis by weight.
2. The pounds of air required per pound of fuel.
3. The pounds of air actually supplied per pound of fuel.
4. The weight flue gases per pound of fuel.
5. The ratio of the air supplied per pound of fuel to that theoretically required.
6. Heat Balance.

Let us take for example data from an oil-burning test with a Hohenstein marine water-tube boiler made with California oil by the U. S. Naval "Liquid Fuel" Board. The analysis by weight of the oil fuel was as follows: carbon, 81.52 per cent; hydrogen, 11.01 per cent; sulphur, 0.55 per cent; oxygen, 6.92 per cent. The analysis of the chimney gases by means of an Orsåt apparatus was by volume as follows: carbon dioxide, 8.6; oxygen, 11.0; carbon monoxide, 1.1; nitrogen, 79.3. The temperature of the boiler room was 98° F., the temperature of the steam for atomization 352° F., and that of the escaping chimney gases 535° F. The equivalent evaporation from and at 212° F. was 12.10 lb. of water per lb. of fuel oil.

1. The flue gas analysis by weight. Applying our rule given above we have:

$$\%\ \text{carbon dioxide} \times \text{mol. wt.} = 8.6\times44 = 378.2,\quad \frac{378.2}{2981}=12.70$$

$$\%\ \text{oxygen} \times \text{" "} = 11.0\times32 = 352.0,\quad \frac{352}{2981}=11.82$$

$$\%\ \text{car. monoxide} \times \text{" "} = 1.1\times28 = 30.8,\quad \frac{30.8}{2981}=1.03$$

$$\%\ \text{nitrogen} \times \text{" "} = 79.3\times28 = 2220.0,\quad \frac{2220}{2981}=74.50$$

$$2981.0 \qquad\qquad 100.00$$

2. The pounds of air required per pound of fuel. By reference to page 329 in this series of lectures, we find that the weight of air required for perfect combustion of each pound of fuel is

$$11.52\,C + 34.56\,(H-\frac{O}{8}) + 4.32\,S.$$

Hence substituting from the analysis of the fuel given above we have

$$11.52\times0.8152 + 34.56\,(0.1101-\frac{0.0692}{8}) + 4.32\times0.0055 = 12.92$$

3. The pounds of air actually supplied per pound of fuel. There are a number of different ways of arriving at this result. The more accurately the data is compiled both in the analysis of the fuel as well as in that of the flue gases, the more nearly will the results tally by the different methods.

$$\text{Air actually supplied per lb. of fuel} = 3.032\,(\frac{N}{CO_2+CO})\,C \quad . . \quad (1)$$

$$\text{Also,} \qquad = 11.52\times\frac{CO_2+\tfrac{7}{3}CO+O}{CO_2+CO}\times C + 34.56\,H \quad (2)$$

A more accurate formula, however, is derived in the following:

Let a = percentage by volume of CO_2
b = " " " " O_2
c = " " " " CO
d = " " " " N

As shown above we can convert these percentages at once into percentages by weight. Let us take x units by weight of the flue gas and at once the percentages by weight become

$$CO_2=\frac{44\,a}{x} \qquad CO=\frac{28\,c}{x}$$

$$O_2=\frac{32\,b}{x} \qquad N_2=\frac{28\,d}{x}$$

and the following equations may be written at once:

Weight of carbon burned to CO_2 in x units by weight of gas

$$=\frac{12}{44}\times44a = 12a$$

Weight of carbon burned to CO in x units by weight of gas

$$=\frac{12}{28}\times28c = 12c$$

Total weight of carbon burned in x units by weight of gas $= 12\,(a+c)$

Total weight of carbon burned per unit by weight of gas

$$=\frac{12\,(a+c)}{x}$$

Total weight of gas generated per lb. of carbon

$$=\frac{x}{12\,(a+c)}$$

The constituents of this last weight are as follows:

Weight of CO_2 per lb. of carbon burned

$$= w = \frac{44ax}{12x\,(a+c)} = \frac{44a}{12\,(a+c)}\ \text{lbs.}$$

$$\text{Weight of } O_2 \text{ per lb. of carbon burned} = w_2 = \frac{32b}{12\,(a+c)}\ \text{lbs.}$$

$$\text{Weight of CO per lb. of carbon burned} = w_3 = \frac{28c}{12\,(a+c)}\ \text{lbs.}$$

$$\text{Weight of } N_2 \text{ per lb. of carbon burned} = w_4 = \frac{28d}{12\,(a+c)}\ \text{lbs.}$$

Total weight of gases w_g per lb. of fuel burned, if there are proportions of carbon by weight in fuel is

$$w_g = \frac{C\,(44a+32b+28c+28d)}{12\,(a+c)}\ \text{lbs.}$$

$$= \frac{C\,(11a + 8b + 7c + 7d)}{(3a + 3c)} \quad \ldots\ldots\ldots \quad (3)$$

Substituting in the three different formulas we derive results as shown.

$$3.032\left(\frac{N}{CO_2 + CO}\right) \times C = 3.032\left(\frac{79.3}{8.6 + 1.1}\right) \times .8152 = 20.22 \quad (1)$$

$$11.52 \times \frac{CO_2 \times \tfrac{1}{2} CO + O}{CO_2 + CO} \times C + 34.56\,H = 11.52 \times \frac{8.6 + 0.55 + 11}{8.6 + 1.1} \times .8152 + 36.56 \times .1101 = 23.54 \quad \ldots\ldots \quad (2)$$

$$\frac{C(11a+8b+7c+7d)}{(3a+3c)} = \frac{.8152(11\times 8.6 + 8\times 11 + 7\times 1.1 + 7\times 79.3)}{3\times 8.6 + 3\times 1.1}$$

$$= 25.6 \quad \ldots\ldots \quad (3)$$

4. The weight of flue gases per pound of fuel. Since we have computed in 3 the pounds of air supplied per pound of fuel evidently if we add to this weight (1—A), where A is the proportion of ash per pound of fuel we have at once the weight of flue gases per pound of fuel. Taking the result obtained from the accurate formula 3 in the above, we have for our illustrative example

Weight of flue gases per pound of fuel $= 25.6 + 1 = 26.6$

5. The ratio of the air supplied per pound of fuel to that theoretically required. The nitrogen in the flue-gas represents the nitrogen content in the whole amount of air supplied since as we have previously seen, nitrogen is an inactive substance and does not enter into combination in flue gases. The free oxygen which is shown in the analysis indicates an oversupply. Now each unit volume of oyygen is accompanied in air by 3.782 volumes of nitrogen. Hence the actual quantity of air necessary for perfect combustion is proportional to N — 3.782 O. The rate of air supplied to air theoretically required is, therefore

$$\frac{N}{N - 3.782\,O} = \frac{79.3}{79.3 - 3.782 \times 11.0} = 2.05$$

As a check on the above result let us apply the ratio of results computed in 3 and 2.

$$\text{ratio} = \frac{25.6}{12.92} = 2.00$$

which is practically identical. An error is liable to creep in the analysis of the fuel, the chimney gas or in both, consequently great care must be observed if true and concordant results are desired.

6. The heat balance—

(a) The heat lost in the flue gases. In our study of economizers we have previously found on page 267, that the heat lost in the flue-gases per pound of fuel is 0.24 W (T — t), in which W is the weight of gases formed per pound of fuel, 0.24 the specific heat, T the outgoing temperature of the gases and t the entering temperature. Hence substituting our value for W obtained in 4, we have

$0.24\,W\,(T - t) = 0.24 \times 25.6\,(535 - 98) = 2683$ B.t.u.

Substituting in Dulong's formula derived on page 250, I find the total heat value of the fuel to be

$$14{,}600\,C + 62{,}000\left(H - \frac{O}{8}\right) + 4000\,S$$

$$= 14{,}600 \times .8152 + 62{,}000\left(.1101 - \frac{.0692}{8}\right) + 4000 \times .0055$$

$= 18{,}202$ B.t.u.

Hence percentage of heat loss in flue gases

$$= \frac{2683}{18202} = 14.7$$

(b) Loss due to moisture formed by burning of hydrogen. On page 250 we have the following formula for losses of this nature:

Heat loss in moisture per lb. of fuel $= (9\,H + W)\,[212.9 - t + 970.4 + 0.48\,(t_s - 212)]$

Since our analysis shows no water present as such in fuel W = O. Hence, substituting, we have

$9 \times .1101\,[212.9 - 98 + 970.4 + 0.48\,(535 - 212)] = 1326$ B.t.u.

Hence percentage heat lost in moisture

$$= \frac{1326}{18202} = 7.3\%$$

(c) Loss due to incomplete combustion of carbon. Since on page 329, we find that 14,600 B.t.u. should be given out in perfect combustion, we have a definite loss when carbon monoxide is formed as only 4450 B.t.u. are given out per pound. Hence such a loss is evidently computed by the formula,

$$C \times \frac{10{,}150\,CO}{CO_2 + CO}$$

$$.8152 \times \frac{10{,}150 \times 1.1}{8.6 + 1.1} = 938 \text{ B.t.u.}$$

Hence percentage heat lost in incomplete combustion

$$= \frac{938}{18202} = 5.2\%$$

(d) Loss due to superheated steam used in spraying oil is

$$0.48 W_s\,(T - t_s)$$

in which W_s is the lb. of steam used in atomization per lb. of fuel, T the temperature of out-going gases, t_s the temperature of the steam used in atomization and K is the specific heat of superheated steam for the range. Substituting

$0.48 W_s\,(T - t_s) = 0.48 \times 0.770\,(535 - 352) = 67.5$ B.t.u.

Hence percentage heat lost in superheated steam of atomization

$$= \frac{67.5}{18202} = 0.4\%$$

(e) Stray losses. Under this column is classed all other losses; such as, radiation, air drafts, etc. This is compiled by adding all the entire losses together with the heat absorbed by the boiler and subtracting this total from the total calorific value of the fuel. In performing this operation, we find that in this case the total stray loss is 1452.5 B.t.u. Hence stray loss

$$= \frac{1452.5}{18202} = 7.9\%$$

(f) Heat absorbed by boiler. This is computed by taking into account the total heat represented in the pounds of steam formed per pound of fuel consumed as illustrated in detail on page 332. In our example here given, we have total heat absorbed by the boiler

$12.10 \times 970.4 = 11735$ B.t.u. per lb. of oil fuel.

Hence boiler efficiency

$$= \frac{11735}{18202} 64.5\%$$

Thermotwisters.

1. In a government test on a marine boiler made with California oil the following data were taken. The analysis by weight of the oil fuel was as follows: Carbon 81.52%; hydrogen 11.01%; sulphur 0.55%; oxygen 6.92%. The analysis of the chimney gases by means of an Orsat apparatus was by volume as follows: Carbon dioxide 6.6%; oxygen 12.6%; carbon monoxide 0.4%; nitrogen 80.4%. The temperature of the boiler room was 96° F., the temperature escaping chimney gases 743° F. and the temperature of the atomizing steam 378° F. The equivalent evaporation from and at 212° F. was 11.19 lb. of water per lb. of fuel oil. Determine the heat balance for the test.

SOLUTION OF THERMOTWISTERS—NINTH LECTURE.

1. A stack is 125 ft. high. The flue gases have a temperature of 475° F., and the outside air is at 60° F., atmospheric pressure being 14.7 lb. per sq. in. How many inches of water will the draft gauge read?

On page 397, I find the following formula for draft in inches of water:

$$D = 0.52\, H \cdot p \left[\frac{1}{T_1} - \frac{1}{\left(\frac{n}{n+1}\right) T_2}\right]$$

where $H = 125$, $p = 14.7$, $T_1 = 459.4 + 60$, $T_2 = 459.4 + 475$, assume $n = 25$.

$$\therefore D = 0.52 \times 125 \times 14.7 \left[\frac{1}{519.4} - \frac{1}{\frac{25}{26}(934.4)}\right]$$

$$= 956\,[0.0\,1925 - 0.001113] = 0.78 \text{ ins. Ans.}$$

2. It is desired to design a stack to burn anthracite buckwheat coal to accommodate 2000 boiler horsepower. What are the proper dimensions at sea-level?

In order to apply Kent's tables given on page 398, it is necessary to reduce 2000 boiler horsepower to the horsepower assumed by Kent.

1 boiler horsepower is equivalent to $34.5 \times 970.4 = 33{,}500$ B.t.u. per hr.

Assuming 1 lb. of coal to have a calorific value of 14,000 B.t.u., 5 lb. will have $5 \times 14{,}000 = 70{,}000$. Hence it is evident that a stack designed from Kent's horsepower assumption will be ample even though our boilers operate under 50% efficiency.

I find on page 398 that the proper height for a stack to burn anthracite buckwheat coal is 150 ft. Hence looking in the table I find that the effective area for 2130 horsepower is 52.23 sq. ft., requiring a total area of 56.75 sq. ft. or a diameter of 102 inches. An equivalent square chimney would be 91 inches. Ans.

PACIFIC COAST GAS ASSOCIATION.

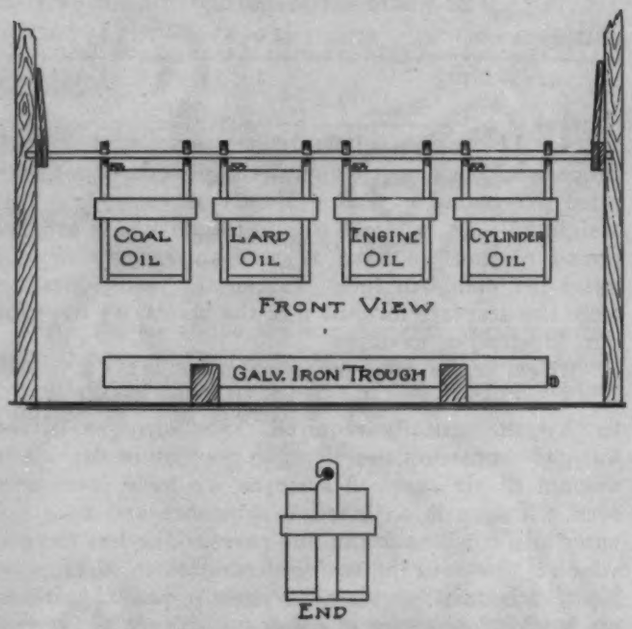
The recently adopted constitution and by-laws of the Pacific Coast Gas Association have appeared recently in printed form and are being distributed to the members of the association. The paper of C. L. Cory on Rates for Gas Service is also being distributed in printed form, according to the desires expressed at the recent convention. The wrinkles reported at the last convention appear in the following pages.

WRINKLE NO. 1.

DEVICE FOR HANDLING LUBRICATING OILS IN SMALL GAS WORKS.

BY F. H. HESS.

Illustrated below is a sketch describing a simple device for handling lubricating oils in a small gas works. It is made by making six-piece crates for ordinary five-gallon square cans and extending the side



Device for Handling Lubricating Oils in Small Gas Works.

braces above the cans sufficiently to allow hooks for suspension on a gas pipe shaft. This shaft may be supported by simple braces from the studs of the building. A galvanized iron trough on the floor is a good plan for catching all the oil spilled.

WRINKLE NO. 2.

SPLIT T-BOLTS FOR HOLDER PATCHES.

BY D. J. YOUNG.

Some time ago it became necessary to patch two large holes in a 300,000 ft. holder which was in regular use. The writer has had some experience with T-bolts for this purpose, but on account of the size of the patch we tried to get something better, and finally devised a split T-bolt, which is shown in the accompanying sketches. On account of being unable to purchase this type of bolt we were compelled to make them in order to do a satisfactory job. These were made of half-inch round brass rods bent and threaded as shown in the sketch.

One great advantage in the use of this bolt over the ordinary T-bolt is the fact that the hole through which it is placed in the holder sheet is but very little larger than the diameter of the bolt, and the work can be done with practically no inconvenience from escaping gas.

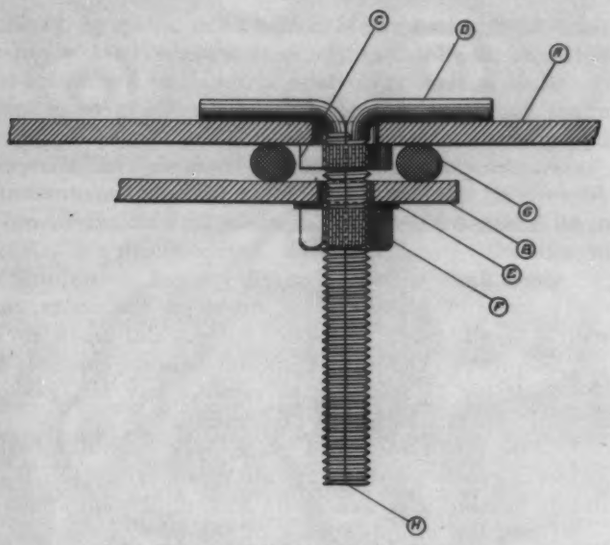


Fig. 1. Split T-Bolt in Place.

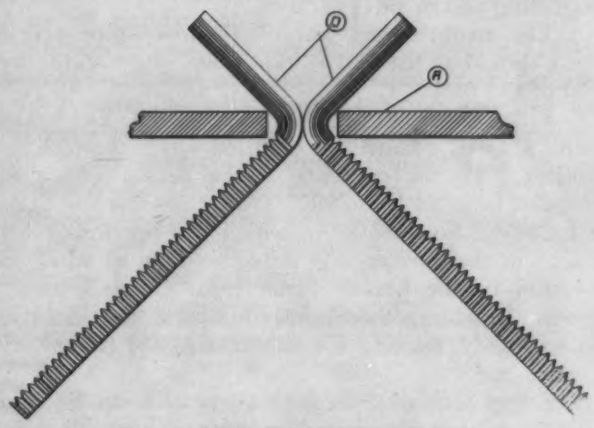


Fig. 2. Split T-Bolt Drawn Apart.

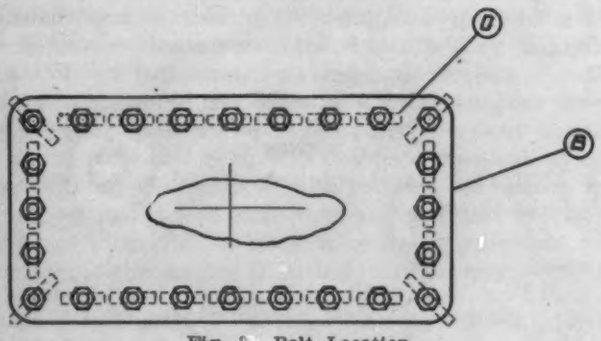


Fig. 3. Bolt Location.

It might be interesting to know that we temporarily closed the large hole by the use of surgeons' plaster and soap, using the surgeons' plaster to hold the soap in place, and it worked very well as a temporary patch.

Explanation of Sketch.

Figures 1 and 2:

A—Sheet of holder.

B—Patch.

C—Lock-nut to hold bolt in place, until all bolts are set.

D—Split bolt.

E—Grummet.

F—Nut which holds patch in place.

G—Rope gasket.

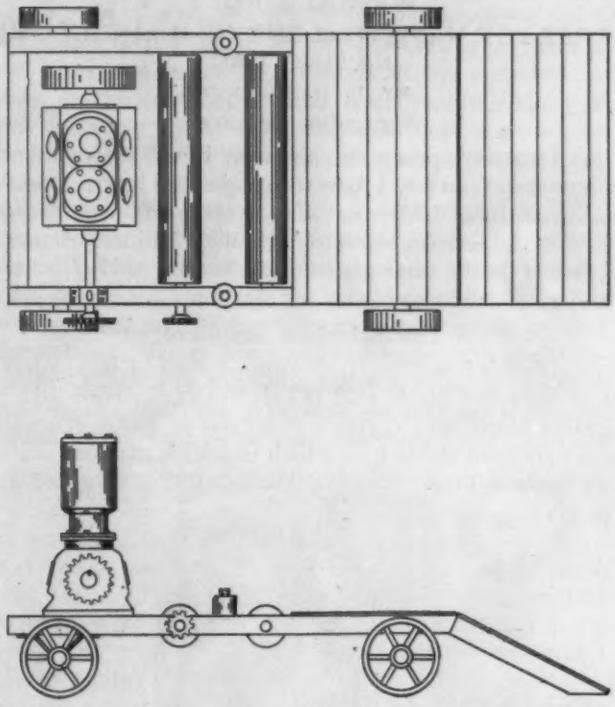
Figure 3 shows the location of the bolts, giving practically a reinforcing ring inside of the patch. The size of the patch that we applied was 48 inches square; is perfectly gas tight and gives no trouble whatever.

WRINKLE NO. 3.

A TREADMILL FOR AUTOMOBILES.

BY WALLACE H. FOSTER.

The device illustrated was suggested from experiments in constructing a compressor automobile for testing high pressure gas mains. In the case in mind, the compressor was mounted on the frame of an old automobile, power being transmitted to the compressor by friction pulleys which were driven by contact with the rear tires after the hind end of the car had been jacked up to clear wheels from the ground.



A Treadmill for Automobiles.

This operated successfully, but the automobile could be used for nothing but testing gas mains. The device illustrated can be used with any automobile and the car is still available for other uses.

A circulating water tank should also be provided on the treadmill and this by very simple hose connections could be used to cool the auto engine as well as the compressor.

WRINKLE NO. 4.

AUTOMOBILE DRIP WAGON.

BY W. R. MORGAN.

The illustration shown is an automobile drip wagon used in the street main department of the San Francisco Gas & Electric Company at San Francisco.

An Automobile Drip Wagon.

The electrically-driven auto has a
Rated speed of .....11 miles per hr.
Average distance traveled daily.....20 miles
Capacity of tank .....250 gals.
Weight of tank, auto and 2 men.....2700 lbs.

Drips are pumped by means of a Mansfield force pump mounted on the wagon.

WRINKLE NO. 5.

TEST FOR NAPHTHALENE ($C_{10}H_8$) IN ILLUMINATING GAS.

BY R. H. BURDICK.

Apparatus Required.

1 vacuum pump or aspirator, 1 wet laboratory or photometer meter, 1 burette graduated in cu. cms., 4 wash bottles, 1 500 c.c. flask, 1 500 or 700 c.c. beaker, 1 25 c.c. pipette or measure, 1 funnel, 1 Bunsen burner, 1 water bath, filter papers, perforated corks, rubber and glass tubing.

The Solutions Required.

Distilled water. Indicator—Lacmoid in alcohol.

Standard picric acid ($C_6H_3N_3O_7$), Solution—11.59 grams picric acid crystals dissolved in 300 c. c. to 350 c.c.; alsolute alcohol, to which is added, distilled water to make 1 litre. Caution—Salts of this acid are explosive.

Standard Caustic Soda Solution—20.27 grams sodium hydroxide dissolved in distilled water to make 1 litre.

1 c.c. Alkali solution = 10 c. c.. Acid solution = 1 grain naphthalene.

Note—In the following test as little rubber tubing as possible should be used, as rubber has a marked affinity for naphthalene. Glass tubing with short rubber connecting nipples is preferable.

Qualitative Test.

Pass about 5 cu. ft. of gas slowly through 2 wash bottle in series, containing 50 c.c. each of the picric acid solution. The formation of a yellow-white precipitate (Naphthalene Picrate—$C_{10}H_8C_6H_3N_3O_7$) in the solution, denotes the presence of naphthalene. If no precipitate appears the gas is practically free from naphthalene.

Quantative Test.

Place 100 c.c. of the Standard Picric Acid Solution in 4 wash bottles (25 c.c. in each) adding 50 c.c. distilled water to each bottle.

Using as little rubber tubing as possible, join the 4 bottles in series. Connect the outlet of the last bottle to the inlet of the test meter. Pass about 5 cu. ft. of gas through the apparatus, at the rate of 1 cu. ft. per hour, noting occasionally the temperature of gas at the meter.

At the end of the required time, shut off the gas, disconnect the wash bottles and rinse the contents of all 4 into a 500 c.c. flask with a little distilled water or alcohol.

Cork flask with perforated stopper, containing a short piece of glass tubing, fitted on the outer end with a small length of rubber tubing and pinch cock.

Connect to vacuum pump and aspirate contents of the flask for 15 minutes, to remove any air, gas or alcohol vapors which may be present.

Close pinch cock and place flask in water bath, and heat gently until precipitate disappears. (N. B.—Before heating it is well to tie cork tightly into flask).

Upon the disappearance of the precipitate, allow the flask to cool, still corked, for 3 or 4 hours, shaking from time to time to wash down any precipitate which may cling to the sides of neck.

The naphthalene picrate (yellow-white precipitate) should at the end of this time, settle to the bottom of the flask.

Filter the solution into a 500 or 700 c.c. beaker, using a small quantity of distilled water to wash precipitate. To the contents of the beaker add a few drops of lacmoid indicator. Titrate against the Standard Caustic Soda Solution which has previously been placed in the burette, and note the point at which the solution in the beaker turns from yellow-brown to green. In adding the Standard Caustic Soda Solution, do so slowly, stirring the contents of the beaker with a glass rod.

Every c.c. of Standard Caustic Soda Solution, less than 10 c.c., required to neutralize the liquid in the beaker, denotes 1 grain of naphthalene in the gas passed during the test. This number of c.c. of the Caustic Soda Solution (or grains of naphthalene) divided by the cu. ft. of gas passed—corrected to 60° F. and 30" Barom.—and multiplied by 100 will give the grains of naphthalene per 100 cu. ft of gas.

Example.

100 c.c. of acid sol. was placed in 4 bottles as directed above.

4.5 cu. ft of gas (corrected to 60 and 30) were passed.

9.3 c.c. of caustic soda sol. were required to neutralize the filtrate and washings (contents of beaker).

Then— 10.0 c.c.
— 9.3 c.c.
4.5 c.f/ .7 c.c.
.155 grain per cu. ft.
× 100
15.5 grains of naphthalene per 100 cu. ft.

Of the various constituents of the hydrocarbon group in illuminating gas, naphthalene alone has an

affinity for picric acid, which is the basis of the foregoing test. For greatest accuracy the Picric Acid Solution should be kept as near 60° F. as possible. If unpurified gas is to be tested it is well to place a wash bottle containing 50 c.c. of 10 per cent oxalic acid between the gas supply and the first picric acid wash bottle, to remove any ammonia that may be present. This oxalic acid should be discarded when the wash bottles are disconnected.

Formulae.

The standard solutions are based on the following:

Picric Acid + Naphthalene = Naphthalene Picrate

$C_6H_3N_3O_7 + C_{10}H_8 = C_{10}H_8, C_6H_3N_3O_7$, or 229.15 parts of picric acid combine with 128.06 parts of naphthalene and also with 40.058 parts of sodium hydroxide (NaOH). Therefore 1.789 grains of picric acid combine with 1 grain of naphthalene and also with .3128 grains of sodium hydroxide. Reducing to grams—.115953 gram of picric acid combines with 1 gram of naphthalene, also with .020269 gram of sodium hydroxide, which is the quantity of acid and alkali required per c.c. of standard solution.

Difficulty was experienced in dissolving 115.935 grams of picric acid in a litre of alcohol or alcohol and distilled water, hence the acid solution noted in the foregoing, is reduced to 1/10th standard strength. With 20.269 grams of sodium hydroxide to 1 litre of solution and 11.593 grams of picric acid to 1 litre of solution, the following equation is deduced: 1 c.c. Standard Caustic Soda Solution = 10 c.c. Picric Acid Solution = 1 gram of Napthalene.

WRINKLE NO. 6.

MAINTENANCE OF REGULATORS.

BY W. J. DORR.

We have a large number of individual high pressure regulators that have been in continuous service for years, some of which cause trouble on account of the diaphragm becoming dry and sticky. To remove all such regulators, bring them to the shop and repair them would mean considerable expense, and in order to avoid this expense we make a house to house canvass, examining all regulators and in cases where they are working hard or leaking slightly, we pour about an ounce and a half of neatsfoot oil onto the diaphragm. This fills up the pores of the leather and makes it pliable again. At the same time an inspection is made of the meters, and the consumers are interviewed to ascertain if the service is entirely satisfactory.

WRINKLE NO. 7.

A TANK REMOVAL.

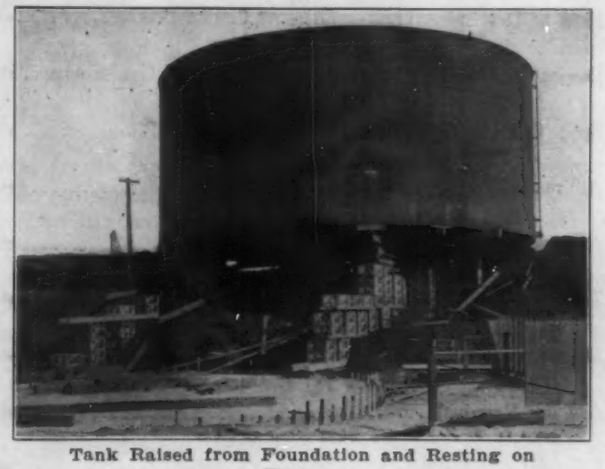
BY SHERWOOD GROVER.

The following is the general description of the story illustrated in the photographs.

Owing to improvement of the water front by the City of Oakland, a strip of our property 150 ft. wide was condemned for a water front street. It so happened that our 30,000 barrel oil storage tank was located on this property, and it became necessary to move the tank to a new location. The most advantageous location was chosen and new pile concrete foundation installed, and the next problem was to get the tank on new foundation, for between the old location and the new stood an immense pile of lampblack, the top of it being higher than the tank itself. Bids were requested for the moving of the tank. Among the bidders one contractor was very much lower than all the others and secured the work. On being asked why his figure was so much lower than the rest, he

Tank Beyond Crest of Lampblack Pile Approaching New Foundation.

replied that he supposed these other fellows were figuring on moving the tank around the pile of lampblack, in which event it would be necssary for them to pass over and make use of some of the construction work of the contractors who were building the seawall for the City of Oakland, and these contractors, thinking there was no other way to move the tank around, were holding everybody up for a stiff price to get past their work. When asked what he was going to do, he replied he would jump the lampblack pile. The pictures show how this was done, and the dates on the back indicate the progress made. The last picture dated April 5th, shows the tank resting on new foundation. Before lowering the tank on foundation, a heavy coating of asphaltum was applied to the tank bottom, and the time necessary for this work was included in the time of moving the tank.



Tank Raised from Foundation and Resting on Frames.

I might add that this tank has traveled some, for it originally came from the San Francisco company, and was located at the North Beach District. A description of the first moving of this tank across the bay was given to the members of the association at that time.

The tank was not damaged in any way during its passage over the lampblack pile.

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CONTENTS

High Tension Direct Current Distribution 473
By C. F. Elwell

The Engineer and Citizenship 478
By James A. B. Scherer.

How to Determine Thoroughness of Combustion 481
By Robert Sibley.

Device for Handling Lubricating Oils in Small Gas Works ... 484
By F. H. Hess.

Split T-Bolts for Holder Patches 484
By D. J. Young.

A Treadmill for Automobiles 485
By Wallace H. Foster.

Automobile Drip Wagon 485
By W. R. Morgan.

Test for Naphthalene in Illuminating Gas 486
By R H. Burdick.

Maintenance of Regulators 487
By W. J. Dorr.

A Tank Removal 487
By Sherwood Grover.

Editorial 488
A Word on Good Roads.
Dam Failures.
Some Simple Arithmetic.

Personals 490

A Get-Together Electrical Luncheon 490

Electrical Contractors' Notes 491

New Catalogues 491

Trade Notes 492

Industrial 492
A Modern Electrical Repair Shop.

Book Reviews 493

News Notes 494

A Word on Good Roads

Some twenty thousand human beings travelled to Palo Alto last Saturday to witness the great intercollegiate football struggle between Leland Stanford Junior University and the University of California. The young men yelled themselves hoarse in support of the team of their choice, while their pretty sisters so soon to wield the ballot vied with each other in so bedecking themselves that if their team failed to win by force, a soft spot in the heart of the onlooker was sure to be reached in any event. Old men and staid matrons looked on and weighed the merits of the game of football in their minds in an endeavor to come to a conclusion as to whether football and an unkempt beard should be both classed together; namely, as "unnecessary roughness."

Be this as it may, no one could look upon such an inspiring sight composed of the best of California gathered from every nook and corner of the great Poppy State without doing some serious thinking. To the engineer it was an inspiration to see the orderly manner in which the crowds were handled. Especially was the long line of automobiles most interesting. It is doubtful if ever in the history of California—and citizens of California by the way possess more automobiles than any other State in the union with but one exception—were there so many automobiles gathered together in one small town. Citizens of cities a hundred to a hundred and fifty miles distant came with automobiles bedecked with flying colors. Many and varied were the opinions expressed as to the condition of the roads encountered. The expenditure of the millions appropriated for good roads by the last State legislature will be watched with added interest.

Dam Failures

The recent bridge failure near Auburn, California, in which an investment of over four hundred thousand dollars was jeopardized, brings forcibly to mind not only the question of investment to the owners, but also the risk of life and property of others in the failure of enterprises of such magnitude. Possibly to the superstitious the beginning of a name with "Au" will in the future inspire awe. For the technical press throughout the country is alive with comments on disasters to projects beginning with those two letters.

Two forceful examples of improperly designed engineering structure are the large masonry dam at Austin, Tex., which failed in 1900, and also the recent horrifying catastrophe at Austin, Pa., on September 30th last. It seems that the engineer called in for consultation when the weakness in the latter dam was first discovered, estimated a horizontal thrust of 78,031 lb. per lineal foot of dam and a vertical downward weight of 113,190 lb. per lineal foot. It is well known that the force resisting failure or sliding is equal to the product of the downward weight and coefficient of sliding friction. Exceed this amount by a trifle excess, and those who have walked forth on a frosty and icy morning in our northern latitudes can testify the acceleration with which nature's laws act by the bumps received in the rear of the anatomy.

In the instance cited above it is evident that the coefficient of slipping should be as large as 0.69 in

order to prevent disaster and yet the very best experimental data we have for the coefficient of sliding friction of one stratum of smooth stone on another stratum is between 0.4 to 0.5 as taken from the well known experiments of Morin as listed in Troutwine's "Engineer's Pocket Book,"

In reviewing mentally the mammoth dams so soon to be built in the west these two serious disasters are horrible examples to ever bear in mind. The time is now at hand when each western State should have a duly deputized inspecting engineer whose duty it should be to check over the computations and pry into the construction of projects of magnitude of this sort. This would mean safety and security guaranteed to life and porperty and at the same time would give added confidence to investors.

Indeed, without corrective steps undertaken at once to insure safety of life and property in the future, there will be no dams by a power site and wide awake promoters should realize that possibly there may not be forthcoming the money for power by a damsite!!

Some Simple Arithmetic

The proposed power projects in the West which are daily announced in the press, cause many serious thinkers to wonder where on earth a market can ever be found to utilize such an enormous output of power contemplated in these vast development schemes. It is interesting to use a little simple arithmetic and the problem is easy of solution.

In the enterprising city of Ontario in southern California an underground system of supply conduits has been scientifically constructed and in successful operation for many years. It has been found that a rancher owning ten acres of land in combination with twenty-nine other ranchers owning each ten acres of land can successfully and properly irrigate his land for citrus fruits and for small farm products by the use of but one share in a joint ownership of thirty miner's inches of water. The water is scientifically applied day and night and no appreciable waste of any sort is allowed.

What does this mean?

It means that one-tenth of a miner's inch of water under scientific application is amply sufficient to irrigate an acre of arid land. Thousands—yes, millions of acres of arid lands are available for irrigation in the West by raising the water from 60 to 180 feet. Such choice lands readily bring from $150 to $250 per acre when properly watered, while in their arid state they go begging at from $15 to $25 per acre It is true that the duty of water will in general vary with character of soil, crops to be raised, natural rainfall and other variables, but the Ontario example is illustrative of what scientific application can do.

One miner's inch of water is by statute 1.5 cu. ft. per min. Hence, since 1 cu. ft. of water weighs 62.5 lbs, to raise one-tenth of a miner's inch of water 60 ft., will require $\frac{62.5 \times 1.5 \times 60}{10} = 562$ foot pounds of energy every minute of time. Let us suppose that our electric pump operates at 50 per cent efficiency. Hence, to irrigate one acre of ground will require 1124 foot pounds of energy every minute. But it requires 33,000 foot pounds of energy utilized every minute to consume one horsepower. Hence to properly irrigate an acre of land under scientific development, raising the water 60 ft. requires but 0.0341 of a horsepower.

The remarkably steady operation of electric pumps necessary in scientific irrigation makes a most ideal hydroelectric load—for the load is even and uniform day and night. The horror of unwieldly peaks never stares the operating manager in the face when supplying power for electrically operated pumps planned for the scientific and economic irrigation of arid lands. Such being the case profits can be realized in the sale of power at the lowest rates. A rate of $30 to $40 per horsepower per year for such a load as is proposed, would make big dividend payers to nearly all the proposed hydroelectric installations which have been favorably reported upon by competent engineers. Assuming a rate of $40 per horsepower per year, this would mean a cost for power of but 0.0341 × $40.00 = $1.36 per acre per year; compared to the enormous crops raised on western irrigated lands, this cost per acre is trifling in consideration.

Let us bear in mind for a minute that in the State of Idaho alone, the State engineer has estimated that there are in his State acreages by the millions that can be irrigated by raising the waters not higher than 100 feet. It requires but a small extension of our figures given above to see that not only is this cheap supply of power, causing the desert to blossom as the rose, a substantial profit-making load for the hydroelectric plant but the total aggregate of power that will be eventually utilized in reclaiming the arid lands of the West will require horsepower by the millions.

The San Joaquin valley and districts in the vicinity of Visalia, California, though wonders of accomplishment in lands reclaimed by electrically operated pumps, are but feeble illustrations of the future possibilities of ultimate arid land reclamation by lifting the water.

The city of Los Angeles seems almost on the edge of throwing itself into a fit of distemper in its proposed ideas of floating its enormous power supply soon to be realized from the Los Angeles aqueduct. This enterprising city has long since won the admiration of the world with its strength and vigor. It is surprising that a careful investigation is not being made looking to the utilization of the surplus power along the proposed aqueduct in the way of reclaiming large acreages of beautiful lands awaiting "for little drops of water to be added to the sand, which makes a heap of difference in the price of the lands." Undoubtedly in would be found that the present clouds of anticipation in oversupply of power would be at once dispelled. This solution would not only be interest paying for water bonds outstanding, but would add to Los Angeles fruitful and populous valleys which would pay her eternal tribute.

The carefully planned government projects of the Dakotas and the Flathead Indian Reservation project of Montana are illustrations of future possibilities to be realized in scientific utilization of every foot-pound of available energy. It behooves those interested in vast power projects to be wide awake to the possibilities of irrigation.

PERSONALS.

Thomas Mirk, of Hunt, Mirk & Co., has returned to San Francisco from San Diego and Los Angeles.

A. B. Cass, president of the Home Telephone & Telegraph Company, Los Angeles, is at San Francisco.

C. L. Chamblin has joined the office force of the California Electrical Construction Company of San Francisco.

F. N. Averill, manager of the Portland house of the Fobes Electric Supply Company, is at San Francisco.

E. G. Williams, the construction manager of J. G. White & Co., has just arrived at San Francisco from New York.

H. W. Beecher, manager of Chas. C. Moore & Co.'s Seattle office, has returned from an extensive trip throughout the East.

H. V. Carter, president of the Pacific States Electric Company, spent the past week at Los Angeles and Monterey.

C. L. Cory, has returned to his San Francisco office, after a business trip covering Los Angeles, Santa Barbara and Sacramento.

Frank Fowden, manager of the Brooks-Follis Electric Corporation, has returned to San Francisco from a flying trip to Los Angeles.

C. H. Pennoyer, Pacific Coast Manager of the National Conduit & Cable Company, spent several days last week in Los Angeles.

C. R. Ray of Medford, Ore., who was for several years manager of the Rogue River Electric Power Company, is at San Francisco.

W. H. Leffingwell, engineer for the Nevada Valleys Power Company, is at Reno on business connected with the new development.

Charles N. Black, general manager of the United Railroads of San Francisco, has been spending a few days in the mountains on a hunting trip.

J. B. Clarkson and W. B. Lewis are again on the road for the Western Electric Company after spending several days at the San Francisco branch.

J. W. Perry, manager of the electrical department of the H. W. Johns-Manville Company, is at Seattle on his way East, after a tour of the Pacific Coast.

H. E. Hudson, sales manager for the Thomas A. Edison Company, Inc., spent the past week at San Francisco in the interests of the Edison primary batteries.

Henry T. Scott, president of the Pacific Telephone & Telegraph Company, has returned to San Francisco after spending several weeks in the Eastern States.

J. W. Gilkyson, commercial superintendent of the Pacific Telephone & Telegraph Company's Southern Division, was a recent arrival at San Francisco from Los Angeles.

Patrick Calhoun, president of the United Railroads, will be at San Francisco during the coming week and will attend the annual meeting of the company, November 22.

H. J. Baker, of the Hunt-Mirk Company, has returned to San Francisco, after spending several days at Pasadena, installing another unit for the municipal lighting plant.

C. G. Pyle, Los Angeles manager for the Standard Underground Cable Company, is receiving the congratulations of his many friends upon the arrival of a baby daughter.

George Drew, who was formerly connected with the General Electric Company, will join the sales force of the Pacific States Electric Company during the latter part of November.

H. L. Davis has joined the San Francisco sales force of The Ideal Electric & Manufacturing Company and Pittsburg Transformer Company with offices in the Rialto Building.

Chas. H. Sheldon, formerly of Kewanee, Ill., was a visitor in San Francisco this week on his way to Los Angeles, where he will establish himself in a manufacturers' agency business.

Wynn Meredith, Pacific Coast manager for Sanderson & Porter, is expected to return to his San Francisco office during the coming week after a long stay in British Columbia in connection with engineering work.

H. A. Lardner, manager of the Pacific Coast office of J. G. White & Co., of New York, spent the past week on an inspection tour through the interior of California, accompanied by C. J. Rhodin, the firm's hydraulic engineer.

Frederick Pratt and Harold Pratt of New York, who are heavily interested in the securities of the Great Western Power Company, were recent visitors at the Las Plumas power station. They were accompanied in their inspection of the plant by P. T. Hanscom, the general superintendent.

Roscoe F. Oakes, president of the American Ever Ready Company, with headquarters at San Francisco, offered a handsome silver cup as one of the trophies contested for at the golf tournament at Del Monte this week preceding the golf dinner of the Electrical Jobbers Saturday night, Nov. 18.

F. J. Cram, manager of the sales department of the Electric Appliance Company, has returned from an extensive Eastern trip, in the course of which he visited a number of the factories for which his firm are handling specialties. He attended the annual convention of the Jovians at Denver.

G. F. Chellis, an electrical engineer connected with J. G. White & Co., is at Bakersfield in conection with the starting up a new Allis-Chalmers steam turbine unit for the San Joaquin Light & Power Corporation. The steam end of this generating unit is rated at 5,000 kw. and the generator at 6,250 k.v.a. This, in addition to the small steam turbine already in use, gives the steam plant a total capacity of 7,000 kw. at 80 per cent power factor.

Chas. H. Sheldon, manufacturing agent for Southern California, representing the Kewanee Boiler Company of Kewanee, Ill.; Kewanee Water Supply Company of Kewanee, Ill.; Whirlpool Mixer & Machinery Company, Wilwaukee, Wis.; Pfaustiehl Electrical Laboratories, Chicago; Bourne-Fuller Co., Iron and Steel, Cleveland; Federal Steel Fixtures Co., Chicago, will open offices at once in Los Angeles, 705 Auditorium Building.

A GET-TOGETHER ELECTRICAL LUNCHEON.

As a result of P. S. Dodd's suggestion that a permanent organization of electrical men be formed at San Francisco, the temporary committee has made arrangements to hold the initial meeting at a local cafe on November 28. On November 14 a meeting of the representatives of the contractors, jobbers, manufacturers and central stations was held at the offices of the Journal of Electricity, Power and Gas and plans formulated for binding these allied interests into one organization, whose prime purpose is to educate the people in the use of electricity.

The meeting on November 28 will be addressed by Albert H. Elliott on the subject of co-operation, with five-minute talks from W. S. Hanbridge, T. E. Bibbins, Geo. C. Holberton and Andrew Carrigan. Attendance at this first meeting will be by invitation, but as soon as the project is launched every man interested in boosting the sale of electric current and apparatus is invited to join in the organization.

This will probably be formed as a local branch of the Commercial Section of the National Electric Light Association.

ELECTRICAL CONTRACTORS' NOTES.

Seth Cohn of the Atlas Electric Company of San Mateo, was at San Francisco last week.

The iron work for the Standard Oil's new building has been let. The contract amounted to $67,438.

Frank Somers, manager of the Century Electric Company of San Jose, was at San Francisco last Wednesday.

A modern hotel building is planned for the northwest corner of Ellis and Taylor streets. The cost will run $300,000.

H. C. Reed, manager of the electrical department of the Pacific Fire Extinguisher Company, has returned from a business trip to Portland.

Los Angeles contractors expect to have a large gathering of southern contractors at the electric show which takes place there between November 25th and December 9th.

L. H. Sly is building a $500,000 apartment house on the corner of Powell and California streets. Mr. Sly in the past has erected a number of large buildings. In all of his building operations he uses non-union labor.

A. E. Brooke-Ridley has been awarded a contract amounting to approximately $1000 for electric wiring in the building on the corner of Market and Stockton streets, which is occupied by Roos Bros.' and Goldman's stores.

The Butte Engineering & Construction Company has been awarded the contract for erecting seven steel illuminating arches on one of the principal streets of Marysville, Cal. The arches will be similar to those in use on Fillmore street, San Francisco. There will be 120 incandescent lights on each arch and a tungsten cluster in the center.

A few suggestions in reference to developing a store trade:

The question is—How shall the contractor develop this electric store out of his present business? And the answer is advertise and by advertising, I mean, do everything that you can think of to make your store popular and profitable. Advertising does not mean printed matter or large expenditures of money, but any one of the thousand little schemes to make men and women buy. After you have secured the best available location, had your store attractively decorated and installed a real salesman, do this sort of thing:

Put cards in your windows explaining what the appliances are for, how much they cost to run an hour, and the price. Remember the public is ignorant of these things and often does not even recognize a toaster or a vibrator.

Hang a cigar lighter over the counter with a card reading: "Light your cigar here."

Follow the weather and the seasons. On a boiling hot day put a battery of fans on a table just inside your door to blow out over the sidewalk. And during the cold snaps set a luminous radiator on the counter with a card "Warm your fingers here," and turn it on whenever there are customers in the store.

Back this up in your newspaper advertising. Make it seasonable and talk about one thing in an ad.

Have sales of irons, heating pads or fans when the weather gives them especial appeal. Sell them cheap for a day and advertise the price.

Use street car cards occasionally, but don't waste money by putting them on lines running through sections of the city where there are few logical prospects for the goods advertised.

Make your windows work all the time. Keep them always new and interesting. It isn't so hard if you give it a little thought.

Have the appliances all connected ready to run and when you get in something new, say a drink mixer, call up the druggists and the cafes and arrange to trot it around and show it to them.

Lay out a schedule of seasonable business, month by month, on cards, so you can always have a reminder before you. For instance:

Don't forget to canvass livery stables just before ice comes and sell them emery motors for grinding horseshoe caulks. Blacksmiths will look long on the forge blower at the same busy season.

Push the vacuum cleaner hard at spring and fall house cleaning time.

Go after the bottlers of beer and soft drinks when the hot weather first commences. It is hard to get their attention during the rush, but bottle washers should be most attractive at the close of spring.

There is one best time to sell most every electrical appliance, and the profit is largest right then because it costs less to sell. Work up a twelve months' plan of campaign and decide that you'll be the most enterprising merchant in your city, and you will be.

In short, it's high time for the contractor to take hold of his business with both hands, both feet and his whole brain, and make his sign mark the headquarters for electrical merchandise. There's an important question to be answered in this country before long and that is—Who is going to own the electric store?

Don'ts for Electrical Contractors.

Don't close your private office door and leave word you are not in. If you are out open the door and leave it open.

Don't refuse to see anyone that calls. You may not recognize real business when it comes in. The most important men are most easily interviewed.

Don't tell a collector that you have not had time to look over his bill when the account should have been checked up and paid sixty days previous. He knows your game and would rather you would tell him you can't pay it.

Don't promise a man you'll mail him a check unless you mean it. He depends on your promise and is up against it if you fail him, and incidentally puts you down as N. G.

Don't talk about the new job you have and how much material you will have to pay for it to the man to whom you owe three months bills. He is on from the minute you open your mouth.

Don't think that these don'ts don't apply to you. There are only a few men in each locality who need not take them to heart.

Don't think that these are all the don'ts that there are. There are more coming. "An Old Timer."

NEW CATALOGUES.

The J-M Packing Expert for October has appeared in print. The pamphlet attractively illustrates products of the H. W. Johns-Manville Company, of Cleveland, Ohio.

The Westinghouse-Church-Kerr and Company have just issued an interesting and attractive publication entitled Central Power Stations. The booklet describes and illustrates the engineering installations supervised and constructed by this company.

G. A. Wilbur, of San Francisco, agent for the Duncan watthour meters, manufactured by the Duncan Electric Manufacturing Company, of Lafayette, Indiana, is distributing bulletin No. 21, just published, on instructions for installing, reading, cleaning, repairing and testing Duncan watthour meters of the direct current.

The popular line "National" metal molding is the subject of a new bulletin just issued by the manufacturer, National Metal Molding Company, at Pittsburg. Prominent among the improvements featured is the substituting of the "key-hole" slot in place of the round punching, which change furnishes a basis for standardizing the fittings, the variety of which is thereby lessened.

INDUSTRIAL

A MODERN ELECTRICAL REPAIR SHOP.

The Farnsworth Electrical Works of San Francisco is operating one of the largest electrical manufacturing shops of the West, employing about twenty-five men. They also carry a large stock of new and second-hand apparatus for sale and for rent, as shown in the accompanying illustration.

The shop is modern and well-equipped with all kinds of iron and wood-working tools, including lathes, planers, shapers, drills, saws, winding machines, taping machines, steam baking oven and two 10-ton cranes serving the entire shop. Much of this apparatus was designed and made in this shop Individual motor drive is used for all tools except where group drive is more advantageous, twelve motors ranging from ½ to 10 h.p. being employed.

Testing Department Farnsworth Electrical Works.

Sales Department Farnsworth Electrical Works.

The testing department is well equipped to give a final running test to all apparatus ranging in size from a 1/10 h.p., 100 volt, d.c. motor to a 250 kw., 11,000 volt, a.c., 1200 volt, d.c. railway motor generator set. The board is equipped for switching from 110, 220 and 500 volt direct current and any voltage up to 2400 alternating current, one, two or three-phase. This wide range of a.c. voltage is obtained by means of specially built 125 kw. polyphase transformers and regulator heads, also constructed by the company. Furthermore, the company has designed and made a special high voltage transformer giving a range up to 30,000 volts for insulating tests. These special transformers are situated in a fireproof concrete vault in the basement and current is taken from the San Francisco Gas and Electric Company's mains at 2400 volts a.c. and 110-220 volts d.c. The 500 volts d.c. is obtained from a motor generator set on the premises.

All d.c. and a.c. small machines are given the regulation running and insulation tests and where necessary they are belted to a shop generator to give full load conditions. All a.c. high voltage machines are given the standard A. I. E. E. tests with double voltage on the coils to ground and are then run under full voltage conditions.

One of the most important lines of this company's work is that of redesigning and reconstructing obsolete types of apparatus so as to be adapted to present day usage. A recent example was the reconstruction of a 250 kw., 1100 volt General monocyclic generator into a three-phase, 60 cycle, 2400 volt machine which has been in constant use since reconstruction with perfect results. Recently also a 350 kw. revolving armature Westinghouse generator was redesigned to work in multiple with the General Electric machine.

The manufacture of transformers of all voltages and all sizes is another important and growing branch to which special attention is being devoted. One of the illustrations shows three 50 k.v.a. station type, oil-cooled transformers, 11,000, 10,450, 9900 volt primary, 2200 volt secondary, and also one 220 volt primary, 27½ volt secondary Mazda lamp transformer. Apollo silicon steel is used in these transformers and it is claimed that their design is such that they compare favorably in efficiency, regulation and losses with any standard make now on the market. The low voltage transformers are manufactured in sizes from 250 watts to 10 kw. and high voltage transformers can be supplied in any size up to 100 kw.

Especial attention is paid to the needs of construction contractors, a full line of motor-driven hoists, crushers and centrifugal pumps being carried either for rent or for sale.

Inasmuch as over 12,000 jobs have been handled by this firm, they have collected a most valuable fund of information on the construction and characteristics of all makes of electric motors and generators. Consequently they are peculiarly well equipped to advise on the redesign of old apparatus and their mechanical facilities enable them to perform this work quickly and well. In addition to the repair and construction of apparatus, they are also equipped for its installation in industrial establishments, having recently installed a number of complete power plants.

TRADE NOTES.

The Jeffrey Manufacturing Company of Columbus, Ohio, manufacturers of conveying machinery, power transmission machinery and coal mine equipment, have recently opened a branch office at 1201 American Bank Building, Seattle, for the handling of their business in the Northwest. This office is in charge of Percy E. Wright, one of the engineers from the home office, who has been with the Jeffrey Company for the past ten years, and has spent the past year in Seattle and the northwest territory.

The Southern Pacific Company has just purchased from the General Electric Company two 25-kw., 125 v., 125 v. Curtis turbine generating sets for baggage car train lighting.

The Mount Hood Railway & Power Company of Portland, Oregon, has just placed an additional order for structural steel with R. A. Deutsche, president of the Structural Steel Company of Seattle.

Southern California Edison Company have placed an order with the American Steel & Wire Company, for approximately 1,600,000 lbs. of 4/0 bare copper strand, for transmission lines, between Los Angeles and Colton and Long Beach and Los Angeles.

In the issue of October 28th, a typographical error was made in the advertising columns of the Journal of Electricity, Power and Gas in stating that the Crocker-Wheeler Company's experience dated back to 1880. This energetic company, with its world-wide experiences, does not, however, date back beyond 1888.

The Tacoma Gas Company has awarded a contract to the Stacy Company of Cincinnati, Ohio, for the construction of a gas tank. The tank will have a capacity of 1,000,000 cubic feet and will be built on the tide flats adjoining River street, and will be connected with the present tank by means of a 24-inch pipe line.

The Hydraulic Engineering Company of Maine have ordered the following apparatus from the General Electric Company for the Mississippi River Power Company, Keokuk, Iowa: 12 waterwheel driven three-phase generators having an aggregate capacity of 108,000 kw.; 12 three-phase water-cooled 110,000 volt transformers having an aggregate capacity of 108,000 k.v.a.; two water wheel driven exciters, one induction motor driven generator, and switchboard.

The Faries Manufacturing Company, Decatur, Ill., the largest manufacturers in the United States of Faries patent adjustable brackets, portables and shades, has just issued a beautiful new catalog showing a complete line of their material. The special feature of this catalog is their adjustable brackets, adjustable portables with green glass hood, and dresser portable; also Mazda clusters with porcelain or steel enameled reflectors, which can be wired for either multiple or series lighting, and for 25, 40, 60 or 100 watt lamps. The Faries Manufacturing Company has just filed an application for a patent on a new style shade holder to be used upon their complete line of shades. These shades are now being manufactured and sold under the Patent Applied For Act.

BOOK REVIEWS.

Direct and Alternating Current Manual. By Frederick Bedell, Ph.D. and Clarence A. Pierce, Ph.D. Size 6 x 8 inches; 360 pages; thoroughly illustrated; cloth binding; second edition, enlarged. Published by the D. Van Nostrand Company of New York, and for sale by The Technical Book Shop, Rialto Bldg., San Francisco. Price, $2.00.

Frederick Bedell and Clarence A. Pierce, as authors of this manual, need no introductory remarks setting forth to the engineering world their fitness for the matter contained within the covers of this book. This manual is a second edition, enlarged, of a former publication. It consists of a series of tests on direct and alternating current apparatus, selected with reference to their practical usefulness and instructive value. A new feature of the edition just published is the matter written on wave analysis. This important subject is too frequently left in the background, for the recluse. The illustrative problem based upon the work of Runge appearing on pages 335 and 336 will be found most helpful for those desiring an exact method of procedure in wave analysis and who are a little unsteady on their feet as to a systematic method. Finally, the relieving feature of the book is that while it deals with thoroughness in such matters as come up for discussion it does not attempt to be exhaustive or complete; on the contrary every effort has been made to eliminate matter of secondary importance, thus giving to the student the very juice of matter discussed without the burden of exhaustive details.

The Design of Static Transformers. By H. M. Hobart, M. Inst. C. E. Size 5½ x 8½ in.; 174 pages; 102 illustrations; clear type; cloth binding. Published by D. Van Nostrand Company of New York, and for sale by The Technical Book Shop, Rialto Bldg., San Francisco. Price, $2.00.

H. M. Hobart presents to the practical engineering world in this book a much needed treatise on the transformer. The book is devoid of theory throughout and the reader is advised to consult certain standard treatises on the subject should he desire to review certain points not understood in the assumptions made by the author as basis of computation and design. Actual numerical problems are carried out in thoroughness and detail. Few typographical errors are encountered. The book being written by a British engineer savors somewhat of usage and practice in vogue in England and the continent, but it will be extremely useful in America to those engaged in practical design of the transformer.

Testing of Electrical Machinery. By J. H. Morecroft and F. W. Hehre. Size 5½ x 8½; 154 pages; 46 illustrations; cloth binding. Published by D. Van Nostrand Company of New York, and for sale by The Technical Book Shop, Rialto Bldg., San Francisco. Price, $1.50.

The authors of this book, engaged in the electrical engineering faculty of Columbia University, have written its contents with the idea in view of meeting a peculiar combination found at the New York University, namely, to devise a series of notes on electrical testing suited to the needs of students pursuing a non-technical course. The book outlines twenty different experiments in all, eleven of which are devoted to direct current apparatus and the remaining nine to alternating current work. A preliminary lecture precedes the detailing of each particular experiment, setting forth the theory underlying the apparatus to be tested. The book is not as tense in its mathematical reasoning as is usually encountered in works of this sort. For this reason the work is especially adapted to that large class of readers outside of our technical school who desire to get a fundamental grasp of the subject without the usual severe mathematical battle encountered in most works of a similar nature.

Electric Central Station Distribution Systems. By Harry Barnes Gear and Paul Williams. Size 5½ x 8½ ins.; 347 pages; 139 illustrations; clear type; cloth binding. Published by D. Van Nostrand Company of New York, and for sale by The Technical Book Shop, Rialto Bldg., San Francisco. Price, $3.00.

Harry Barnes Gear, general inspector of the commonwealth Edison Co. of New York, and Paul Francis Williams, assistant general inspector of the same corporation present in this book a wealth of ideas covering their experiences in the design and construction of electric central station distribution systems. The nucleus matter contained in this publication formally appeared serially in the Electrical Age during the years 1908 and 1909. The treatment is based upon the assumption of a general knowledge of electrical theory such as is possessed by the more advanced students of engineering and by men in practical distribution engineering work. Much of the subject matter of the book is, however, of such a nature as to be easily grasped by practical men who have not had a full theoretical training. The chapters on underground construction and cables coupled with the chapter on distribution economics represent most recent practice in congested centers of the east and will be found valuable to western engineers now meeting with similar problems.

NEWS NOTES

INCORPORATIONS.

NEZ PERCE, IDAHO.—The Lewis County Electric Company, capital $200,000, with headquarters at this city, has been incorporated with C. F. Cunningham as agent.

OLYMPIA, WASH.—Articles of incorporation for the West Coast Railway Company, to be built between North Yakima and Seattle to connect with the Oregon-Washington Railroad & Navigation Company, in King County, have been placed on file with the secretary. The incorporators are Robert Strahorn and A. Smith. The capitalization is $1,000,000. The road is to run through Yakima, Kittitas, Pierce and King counties. It is to be either steam or electric.

MEDFORD, ORE.—Medford is taking great interest in the proposed electric line to run from Ashland to Eugene, incorporated in the State of Washington with a capital stock of $3,000,000 under the name of the Oregon Southern Railway Co. J. Arnold Doyle of Spokane, Wash., and H. M. Farren of Boise, organizers of the company, are in Medford and will apply for a franchise from the City Council at the next meeting.

FINANCIAL.

SEATTLE, WASH.—The Seattle Lighting Company has been granted a 40-year gas franchise by the county commissioners covering territory south of Seattle.

CRESWELL, ORE.—Local citizens have pledged financial support in the sum of $25,000 to the Eugene Belt Line and Interurban Railway and that company will construct an extension into this city.

EUGENE, ORE.—It is expected that contracts for the construction of the first 25 miles of the Eugene-Coos Bay extension will be awarded shortly. The right of way has been practically secured and contracting firms are submitting bids.

HUNTINGTON PARK, CAL.—At a public mass meeting held by the citizens it was decided to campaign for issuing $60,000 in bonds for a municipal water plant, $40,000 in bonds for a municipal electric plant, $10,000 in bonds for a fire apparatus.

MYRTLE CREEK, ORE.—At a special election the people of Riddle voted $15,000 bonds for a water works system, the old plant being inadequate; and $13,000 for a complete sewer system. Both issues were carried by a large majority. Construction work will begin as soon as contracts can be let and the bonds sold.

SAN FRANCISCO, CAL.—One hundred bonds of the San Francisco Gas & Electric Company have been retired, the numbers having been drawn by lot under the terms of the trust mortgage of August 20, 1903. The bonds are part of the 30-year gold bonds of the company's sinking fund, and date from November 1, 1903.

VISALIA, CAL.—G. V. Reed, A. C. Tienken, G. R. Hostetter and F. F. Hostetter, directors of the Lindsay Gas and Water Company, have petitioned the Superior Court for the dissolution of the corporation. The company was capitalized at $75,000 divided into 1500 shares of the par value of $50 each. The petition states that 534 of the shares have been sold.

MARTINEZ, CAL.—A rate war is on in Concord between the Pacific Gas & Electric Company and the Great Western Power Company, which recently entered the Contra Costa field to compete with the former established company. The Great Western is cutting rates on light and power below the schedule now in force with the Pacific Gas & Electric Company, and to retain the business the latter company is reducing its rate to meet that of the new-comer. Manager Don C. Ray of the Martinez district is making earnest efforts to retain this business for the company. The power line of the Great Western has been completed along the water front from Concord through Martinez and Port Costa to Eckley.

HOLTVILLE, CAL.—The City Council has passed an ordinance providing for an election to be held November 29 to vote on the question of issuing bonds for completing the construction of the water works system of the city and for acquiring or constructing fire apparatus. The issue is to be in the amount of $10,000, of which $8000 will be for the water system and $2000 for fire apparatus.

McMINNVILLE, ORE.—Three charter amendments providing that the city issue bonds to the amount of $75,000 have been passed by a large majority at the city election. The amendments are as follows: Authorizing a bond issue of $15,000 for replacing wooden water mains with iron; authorizing bond issues of $30,000 respectively for street improvements and extension of water and light systems.

SAN FRANCISCO.—The finance committee of the Supervisors consented last week to let the Board of Public Works have $7000 additional for laying high-pressure mains by day labor in Second street, between Market and Townsend. The committee also allowed $11,000 in addition to the $10,000 originally given for purchasing cast iron pipe for the Ingleside outlet sewer across Lake Merced rancho. The first amount was set aside on the city engineer's estimate which proved too small.

SAN BERNARDINO, CAL.—The Lytle Creek Power Company of this city has been absorbed by the Southern Sierras Power Company. The latter company paid $160,000 for the property. The Southern Sierras Company is engaged in building a high power transmission line from Bishop Creek, in Inyo County, to San Bernardino, a distance of 240 miles. This will probably replace the supply now being furnished the Lytle Creek system from a steam plant. The Lytle Creek Power was organized seven years ago by local men.

SAN FRANCISCO, CAL.—The San Francisco, Vallejo & Napa Valley Electric Railroad, having defaulted in the interest on its $1,500,000 of bonds, has been sold for $700,000 at public auction. The purchasers will have to take care of a floating debt of $400,000. Three bids were received, one for $500,000, a second for $600,000 and the third for $700,000. The first and third bids were made by a bondholders' committee, consisting of James Irvine and John D. McKee of this city and George R. Sheldon of New York. McKee is vice-president and cashier of the Mercantile Trust Company.

TRANSMISSION.

HAILEY, IDAHO.—The Kilpatrick Bros. expect to put in a power plant at their dam on Silver Creek in the near future that will furnish light and power for Picabe.

VALDEZ, ALASKA.—Henry Deyo, with a crew of surveyors, will make a survey of the Alaska Water, Light & Telephone Company's power site at Sulphide gulch.

RENO, NEV.—What is intended to be a direct competitor for the power business throughout Nevada now controlled by the Hammon interests which have several million dollars already expended in or applied to its mammoth workings in this State, is the Nevada Valleys Power Company. The articles of incorporation provide for a first capitalization of $2,500,000. This is the initial step taken by a combination of Western capitalists toward the construction of big power

plants on Truckee River. Some months ago a power site was taken over at a point near Vista, east of Reno, and rights of way secured for ditches and reservoirs. The promoters of this project are Milton S. Hamilton and F. J. Early of Oakland and their associates. It is proposed to construct at the outset a plant having a capacity of 4000 h.p. to be directed in immediate opposition to that operated by the Hammon or Truckee General Electric interests. Work of building will begin immediately.

SAN JOSE, CAL.—The bid of the Great Western Power Company of $110 for the power pole line franchise that corporation recently asked for has been accepted and the franchise has been awarded.

EUGENE, ORE.—Joaquin Miller is interested in a big electric power plant project on the Siuslaw River, six miles above Mapleton, and it is announced that the plant will be installed early in 1912. Geo. Melvin Miller, brother of the former, is now in Portland arranging for machinery for the plant.

STOCKTON, CAL.—Robert R. Reed, representing the Sierra and San Francisco Power Company, announces that the company will be in operation in this city by December 1. He declares that the company is building from Manteca, where it has its main line, to Stockton, and that it is within four miles of this city.

EVERETT, WASH.—Reports are to the effect that the Stone-Webster Company is preparing for the installation and construction of a power plant in the Sultan basin, deriving its power from the Sultan River. A large dam will be built in the Sultan canyon and this tract flooded so as to form a reservoir for storage of water.

CENTRALIA, WASH.—The Centralia Light & Power Company, which projects the construction of an electric railway line between this city and Rochester, a distance of 10 miles, has practically secured all rights of ways and a 500 kilowatt turbine generator for use in the power house has been acquired. The power is to be supplied by the Eastern Railway & Lumber Company.

HONOLULU, H. I.—A large contract was awarded recently by the Island Investment Company to the von Hamm-Young Company for the hydroelectric plant which the Island company is building between Wailuku and Kahului on Maui, for the purpose of supplying these towns with electricity and light. The contract is for the machinery and calls for its shipment from the manufacturers in the East within 60 days. The plant is a steam one, and California oil will be the fuel used.

OROVILLE, CAL.—Plans have been completed by the Oro Electric Company for the active beginning of construction work at Humbug early in the spring. One of the first developments will be on Yellow Creek. Last February E. M. Ebright filed on 60,000 inches of the waters of Grizzly, Soda, Butte and Yellow Creeks, and later transferred to Grizzly, Soda, the Oro Electric Corporation. It is the plan of the corporation to assemble the water in a 1700-acre storage resesvoir in Yellow Creek Valley, from which point it will be dropped by means of pipe-lines to the mouth of Yellow Creek on the north fork of Feather River, where the powerhouse will be located.

PORTERVILLE, CAL.—Due to new regulations which have been adopted by the Underwriters of the Pacific and new regulations which have been made obligatory upon light and power service corporations through new legislation which went into effect October 22, the Mt. Whitney Power Company finds itself faced with the necessity of a complete reconstruction of their plant within the ensuing five years. First, the power lines which now exist throughout the district must be completely rebuilt. The new regulations call for a clear distance of 26 inches between the power wires, as strung in the familiar triangular form and the third wire at the top must be placed upon a long iron pin, which will carry the regulation porcelain or glass insulator. The new arms of the poles will be considerably longer than at the present time and the distance between the wires sufficient to allow a safe working space. Another change which is made necessary by the new regulation is in the replacement of all circuit breakers on the line.

TRANSPORTATION.

SOUTH VANCOUVER, B. C.—The British Columbia Railway Company will shortly double-track Fraser street in this city.

MEDFORD, ORE.—J. Arnold Doyle of Spokane and F. M. Farren of Boise, organizers of the Oregon Railroad Company, while here announced that they will soon apply for an electric railway franchise through the valley.

KIRKLAND, WASH.—The Pacific States Telephone & Telegraph Company has announced its intention of extending its Seattle service to this city. An order for cables has been placed with the General Electric Company of New York.

PORTLAND, ORE.—Activities of the Oregon Electric Company officials indicate that the Hill electric system is preparing for early construction of the line from Portland to Newberg, McMinnville, with the Dalles, Ore., as the terminus.

RIVERSIDE, CAL.—The City Council has accepted the offer of $25,000 made by the Pacific Electric Railway Company for a franchise to operate and maintain a double track line over the extension of Magnolia avenue, between Arlington avenue and Main street.

PHOENIX, ARIZ.—The City Council has passed an ordinance granting to the Salt River Valley Electric Railway Company a franchise to construct, operate and maintain for a period of twenty-five years, an electric street railway along certain streets, highways and public grounds of the city.

RIVERSIDE, CAL.—The bond of the Pacific Electric Railway Company for $500 has been approved and an ordinance passed granting a franchise to the Pacific Electric Company for the construction and operation of a double track line over Magnolia avenue from Arlington avenue to the intersection of Main and Fourteenth streets.

SAN FRANCISCO, CAL.—Manager George Hark of the Reno Traction Company is in San Francisco to confer with the directors of the company concerning the building of an extension of the electric line from Sparks to the Arkell mine in the Wedekind district. He says that the line may be built immediately for passenger and freight traffic, to haul the ore from the mining district.

LOS ANGELES, CAL.—The Pacific Electric Railway has a large construction force at work rebuilding the Sixteenth street line of the road within the city limits, as far as Rosedale cemetery. The work is under the immediate supervision of Assistant Chief Engineer E. C. Johnson. The roadbed which is being laid is comparable with that put down on Broadway by the Los Angeles Railway Company, which cost approximately $110,000 per mile.

FRESNO, CAL.—Although it is expected that ties for the Fresno, Hanford & Summit Lake Interurban Railroad will be in Fresno by the 15th of this month, another postponement in the beginning of track laying is announced, because it will be impossible to get rails here before the 1st or 15th of December. Efforts were made to secure between 600 and 700 tons of rails in San Francisco, but investigation showed that more than 25 per cent of them were short rails and unsuited for the requirements of the road. Inability to use these rails has made it necessary to get the entire supply of about 4500 tons from Pueblo and they will not begin to arrive here before December 1.

SAN JOSE, CAL.—At the regular weekly meeting of the Town Trustees of Alviso rights of way over the two principal Alviso streets were granted to the San Jose Terminal Railroad Company, which has announced plans to build an interurban road connecting San Jose and that place. The plans call for the immediate beginning of work and rights of way have now been secured for the entire 12 miles of line. The projectors of the new road plan to make a summer and winter resort of Alviso and it is expected that the old water route to San Francisco will be revived as a passenger and freight line with the opening of the road. John A. Mehling, E. M. Rea and M. J. Gardner, officers of the company, presented the petition of the company to the Alviso trustees.

FAIRFIELD, CAL.—For the purpose of building a railroad from Cement to Tidewater, touching the slough at a point near Rush's landing, about two miles south of Suisun, the Cement, Tolenas and Tidewater Railroad Company has been incorporated. Articles of incorporation were filed with the county clerk. The life of the company is 50 years and the capital stock $500,000 divided into 5000 shares at a par value of $100 each. The sum of $6000 has been subscribed and paid into the treasury. R. B. Henderson, A. D. Plaw, W. T. Barnett, Paul C. McCarthy and F. D. Madison are the incorporators. Grading for the line was commenced about two years ago, but work was suspended after a few months. It is stated now that operations on the road will again be commenced at an early date.

ILLUMINATION.

COLTON, CAL.—The City Trustees through Attorney Byron Waters have been presented with the application of the Southern California Gas Company for a 50-year franchise through the streets of Colton. C. M. Grow is superintendent of the company.

ENCANTO, CAL.—The agent of the San Diego Gas and Electric Company is canvassing here to see how many residents will utilize gas if provided. From the success he is meeting it is probable that Encanto will soon be connected with the San Diego plant.

ABERDEEN, WASH.—The Council has passed an ordinance granting to the Municipal Heat & Light Company a franchise to construct and maintain upon certain streets and alleys of Aberdeen, pipe lines, wires and conduits for the transmission of light.

WOODVILLE, ORE.—The Town Council has entered into an agreement with the Rogue River Electric Company under the terms of which the company contracts to install an electric light plant complete in the town of Woodville according to the plans and specifications.

EUGENE, ORE.—The city's $25,000 electric street lighting bonds have been sold to local people and the work of installing the lights will begin at once. The people have voted $57,000 more bonds for the further extension of the street lighting system. The latter issue will also likely go to local people.

RIVERSIDE, CAL.—The Southern California Gas Company has filed correspondence with Mayor Evans revealing to members of the Council the purpose of the company to proceed at an early date with extension of its high pressure lines to Arlington; serving both Brockton avenue and residents along the new Magnolia extension.

HUNTINGTON BEACH, CAL.—G. G. Ivy is planning to erect a gas plant here at an early date. He is now securing names of those who will use it. A high pressure system will be used and each block will be so piped that it can be supplied when it is fully built up with houses. One of the gas mains will be laid on Olive ave., branching each way into the alleys, extending from Main to Fifteenth streets, will also be laid in other streets. The generator of the manufacturing plant is to be of a capacity to supply 50,000 cubic feet of gas in ten hours. Mr. Ivy will have charge of the plant.

MADERA, CAL.—Madera citizens are looking forward to having a new gas system in operation in a short time, Contractor F. C. Roberts having arrived from San Francisco and arranged for hastening of laying the mains. It is expected the pipe will all be down in two weeks to prevent interference with street paving work already planned.

NORTH YAKIMA, WASH.—Chief Engineer D. F. McGee, of the Pacific Power & Light Company, and Consulting Engineer D. C. Henny were at the Wapato canal in the Naches recently investigating conditions preparatory to the installation of various improvements and changes. The Pacific Power & Light Company will also improve the local street lighting system. The present old style multiple arc lights will be replaced with modern arcs, and changes will be made in the local substation.

TELEPHONE & TELEGRAPH.

VANCOUVER, B. C.—The British Columbia Telephone Company has plans prepared for extensive telephone improvements here.

McMINNVILLE, ORE.—Carlton's City Council has granted the Carlton Mutual Telephone Company a ten-year have been printed repeatedly.

ASTORIA, ORE.—Grangers in the vicinity of Knappa and Svenson, have decided that to supply the proper service in a long needed telephone line they would organize a stock company, the stock to be subscribed by the farmers and the line to be built and operated by them.

ARCATA, CAL.—F. Blake, proprietor of the Independent telephone line, has been very busy for the past week preparing to build about two miles more of the telephone line which will run out to the mouth of Mad River and will take in the greater number of ranches along the way.

CONCORD, CAL.—A company to be known as the Mt. Diablo Telephone Company has been incorporated here. It is the plan of the directors to construct 22 miles of telephone wires in the country outside of Concord. The lines will run through Concord to the Ygnacio Valley and Clayton. The officers of the new company are: H. C. Wetmore of Concord, president; Joseph F. Frank of Clayton, vice-president; Charles Gordon of Clayton secretary and treasurer.

SAN FRANCISCO, CAL.—Edward J. Nally, first vice-president and general manager of the Postal Telegraph Cable Cimpany, is at San Francisco. Nally's Western trip has given rise to numerous reports that his mission to San Francisco has to do with the Postal's absorption in California of a number of independent telephone companies, with a view to putting the telegraph company of which he is the managerial head on a better footing with its rival, the Western Union, which has taken control of the Bell Telephone Company's interests in this country.

LOS ANGELES, CAL.—It is generally conceded that a sweeping victory for municipalities in the State of California which seek to control telephone companies by franchises, was scored when the Supreme Court affirmed the opinion of Judge Walter Bordwell of the Superior Court, who declared that the city of Pasadena had the right to make the Pacific States Telephone & Telegraph Company take out a franchise in order to operate in that city. In its opinion the Supreme Court establishes a precedent which will in time be the ground for the city of Los Angeles to require the Pacific States Telephone & Telegraph Company to take out a franchise for the right of that company to operate in Los Angeles which terminates in 1916.